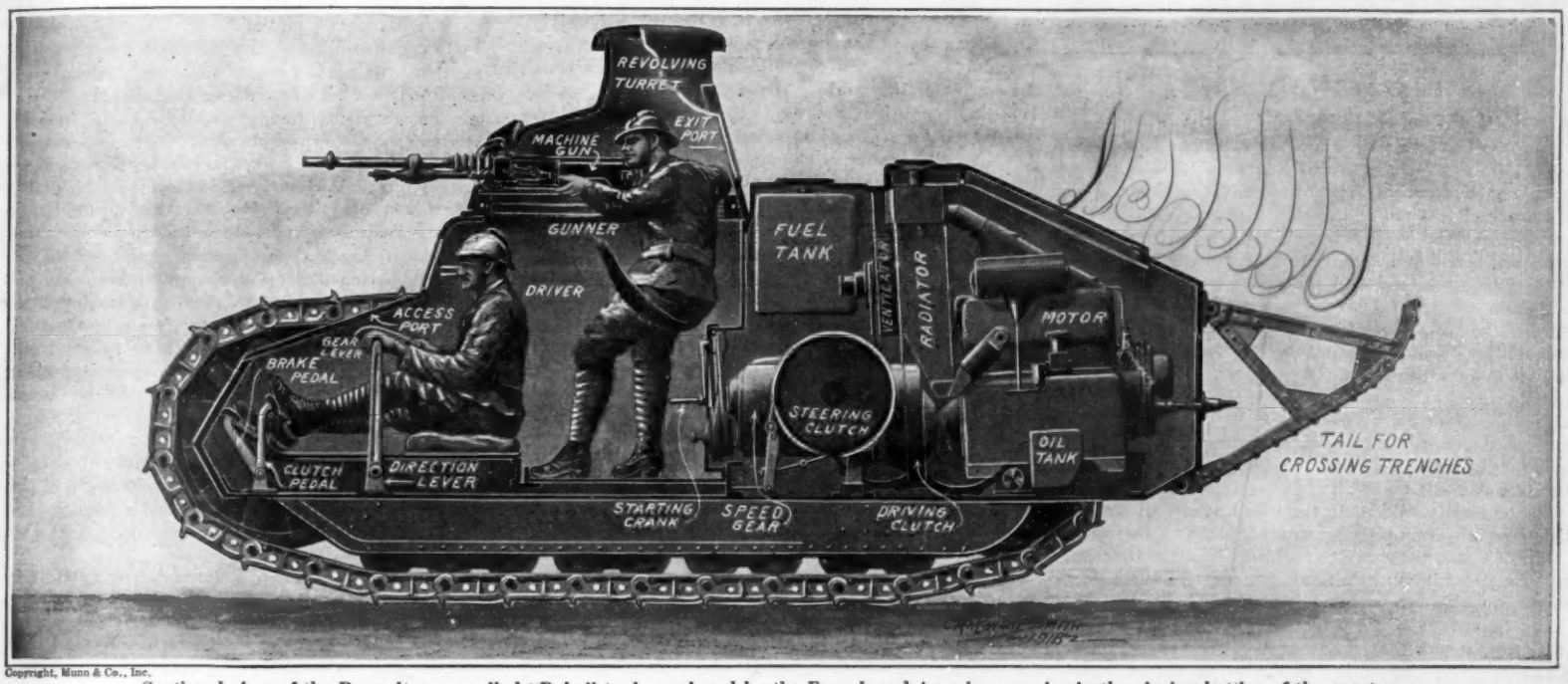
SEVENTY-FOURTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIX.] NUMBER 22 NEW YORK, NOVEMBER 30, 1918 [10 CENTS A COPY $5.00 A YEAR



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Sectional view of the Renault or so-called "Baby" tank employed by the French and American armies in the closing battles of the great war

The Secret of the "Baby" Tank

IT will always remain a troublesome feature of military writing that the most interesting things cannot be described in full until they have ceased to be timely. A month past, when battles were still raging on the fields of France, a drawing of the interior details of a small French tank would have been most opportune, since hundreds of these weapons were being used by the French and the Americans. But military exigency precluded the presentation of such material for the very reason that it was then too opportune and too interesting —particularly to the enemy. So it remains for us to publish details of this kind from time to time as they are released by the military authorities, even if hostilities have been brought to a close.

The small tank shown in the accompanying drawing and photograph represents the outcome of improved tank tactics. These tactics, which have been covered at length in a number of articles appearing in these columns for several months past, caused the abandonment of the heavier and larger British and French tanks in favor of the smaller type. Thus the big Allied tanks, weighing in the neighborhood of 25 tons and carrying a crew of eight to ten men, were replaced early this year by the "Whippet" tanks of the British and the "Renault" tanks of the French, both these types being small, two-man tanks, carrying a single machine gun or small cannon as compared with the four to six guns of the larger tanks.

Tank tactics are now based on the perfect coördination between tanks and infantry; and with the older, slower moving tanks it was found wellnigh impossible to keep these two arms moving in perfect unison. Again, the early tanks were cumbersome, difficult to maneuver, and withal, presented a more than fair mark to enemy gunners. Because of their size and the large crews required, the number of tanks available for an attack was strictly limited. Furthermore, in actual practice the power of the tank and its ability to crush enemy defenses were found to be of secondary value only, since the main object is to carry guns, ammunition, and the crew.

It remained for Louis Renault of Billancourt, France, to develop a fast "Baby" tank to meet the new requirements. This he did, and fleets of his tanks made their appearance this spring, shortly after their counterparts, the British "Whippets," had scored new victories against the enemy. The Renaults were a success from the start, being adopted by the French army and later by the American forces fighting in France.

The Renault tank, as will be noted in the accompanying illustrations, consists primarily of an elongated armored body measuring about 13 feet in length, 6½ feet in height, and a trifle over a yard in width, equipped with a set of caterpillar treads and a power plant. The armor varies from ¼ to ⅝-inch in thickness, and is of a special chrome steel plate, capable of withstanding small-arms fire and the burst of small shells. The body is surmounted by a revolving turret which carries the single machine gun or the 37 mm. (1½-inch) cannon, with which the tank is armed. Some Renaults are provided with a short-barrel 75 mm. (3-inch) cannon, in which case the turret is rigid.

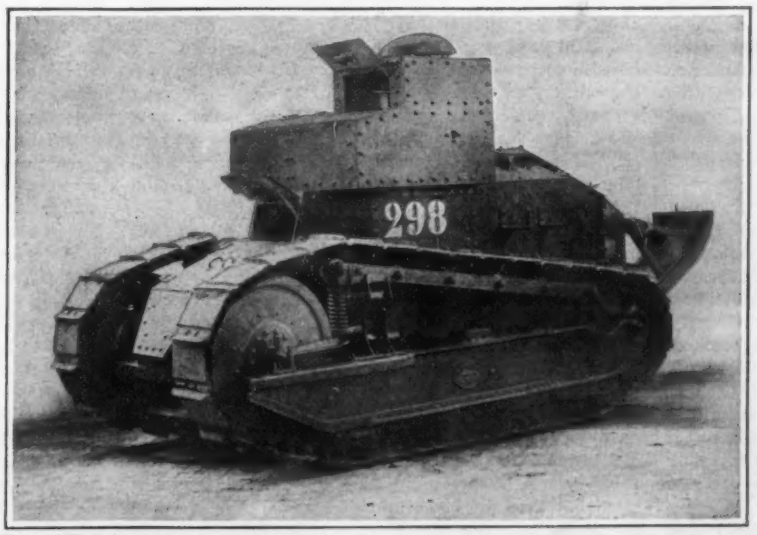
The interior of the Renault tank is divided into two compartments—one for the crew and the other for the power plant. At the forward end sits the driver, with his feet resting on two of the three pedals which control the clutch, brake and accelerator. Three levers are close at hand, controlling the speed and the operation of each tractor belt. Standing immediately back of the driver is the gunner, who operates the gun in the revolving turret. A wide belt or strap serves as a seat for the gunner, who can turn the revolving turret and its gun to any point. Narrow slits, measuring ⅛-inch wide, afford sufficient vision for the driver and the gunner. Entrance to the tank is afforded by the opening of doors immediately in front of the driver's post. An emergency door is also available in the turret.

In the rear compartment is located the Renault engine, fuel tank, and oil tank; the radiator, which receives a constant stream of cold air by means of a special ventilator; and the other members of the power plant. The crank handle for starting the engine extends into the forward compartment, directly behind the gunner.

As for the caterpillar system, it is quite conventional in these days of farm tractors. The power of the engine is transmitted through a pair of large sprocket wheels to the belts, and the endless belts are supported by a system of idlers, rollers and springs as depicted in the photograph. For steering, the familiar method of varying the belt operation is followed; that is to say, if the tank is to turn to the right, for example, the right belt is disengaged from the power plant, whereupon the tank swings around the idle right belt which then acts as a pivot.

The little monster weighs in the neighborhood of 7 tons with its full equipment. It develops a speed of between six and seven miles an hour. While not as formidable a vehicle as the larger tanks, to be sure, the Renault readily shatters all forms of barbed-wire entanglements and solid brick walls.

As for the gymnastic feats of the Renault tank, it is reported that owing to the high tractive effort developed by its belts, together with the judicious placing of the center of gravity, it will climb a 120 per cent grade, or in the neighborhood of a 50 deg. incline. This tank will pass through water 3 feet in depth. And because of the pointed front and the queer tail appendage, the Renault is perfectly at home in any sort of shell-torn terrain. It is seldom that such a tank becomes stuck or stalled even on the roughest journeys; about all that can happen to it is to topple over on its side when a mine or shell bursts close by and creates a crater, and then it is readily righted and again started on its way.



Courtesy L'Illustration

Modified Renault tank which carries a wireless telegraph station

New Deposits of Saltpeter

DEPOSITS of saltpeter covering a surface of 600 square kilometers have been discovered in Piauhy, Brazil. The proportion of potassium nitrate contained is 80 per cent, a content which renders it available for agricultural purposes. The deposit is situated 60 kilometers from Cratheos and is connected by railroad with Camocim.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, November 30, 1918

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Peace and Naval Policy

THE wave of hysterical rejoicing that swept over the United States when our President announced the signing of a truce had many impulses; but none was more strong than the conviction that, with the death of German militarism, there had died also the ever-present threat of war and the ever-accumulating burden of naval and military armaments.

Equally upon land and sea was Germany the pace-maker in the multiplication of armies and fleets, and always she saw to it that any attempt to check the competition by mutual limitation of armaments should be thwarted by her own refusal. At the Hague, against every proposition of reasonableness she set herself with a face of adamant. When Great Britain suggested a mutual reduction of naval programs, based on an agreed ratio of strength between the two navies, Germany turned a deaf ear.

It was clearly evident to the naval powers of Europe that Germany was planning aggression; and for years before the war, the study of problems in naval strategy, as worked out in our own navy, presupposed this power as our probable antagonist.

But the surrender of the German fleet and the passing of Germany as a first class naval power have changed all that. The United States moves up again to its former position as the second great naval power of the world, and it finds itself in the happy position of being one member of an alliance which includes all the other great naval powers—Great Britain, France, Italy and Japan.

Furthermore, it finds itself committed, through its administrative head, to the noble concept of perpetuating our alliance for war as an alliance for peace, by the formation of a great League of Nations, one of the first fruits of which will be that limitation of armaments to which the war-mad German was formerly the unsurmountable obstacle.

Even if it should be found that the world is not yet ripe for a formal League of this character, it is certain that at least an agreement will be reached among the Allied nations to restrict their naval and military programs to a mutually adjusted scale.

In view of these conditions, which cannot be disputed, we learn with astonishment that Mr. Daniels, Secretary of the Navy, wishes to commence the immediate construction of 156 new war vessels, including ten superdreadnoughts and six battlecruisers; and that in addition to all this he is asking the debt-ridden people of the United States to give him a further sum of $600,000,000 for the construction of another lot of 156 vessels, which shall duplicate the first lot.

In other words, in the very hour when the heavens are filled with the rejoicings of the people that the era of wars and of armaments is over, at the very time when the enemy is handing over ten dreadnoughts and five battlecruisers as a pledge of his submission—comes this man of peace with the request that we hurry forward the building of a fleet even greater than the one that is being surrendered, and that we put up yet another $600,000,000 to duplicate the addition.

Verily, the ways of some men are past finding out. Here at the very time when our President is planning a trip to Europe to establish upon an unassailable foundation a League of Peace, we see his favored lieutenant asking the war-weary people of the country to build an entirely new fleet of over 300 warships, including 20 superdreadnoughts costing, in these days of high prices, some thirty millions apiece, and twelve battlecruisers that will cost even more.

Who is the possible enemy that Mr. Daniels sees lurking among the fleets of our Allies (or "associates" if he prefers the term) whose gallant tars have so lately been joined with ours in the task of sweeping the common foe from the seas?

We beg respectfully to suggest to the Secretary that with the ending of the war the taxpayers of the country are more interested in retrenchment and economy and all the other blessed insignia of peace than they are in programs for more ships, guns and high explosives.

And what sort of effect will it have upon our President's efforts at the peace table, when it is recalled that the most voluble member of his cabinet is seeking to double the armed strength upon the seas of the country which the President represents.

Furthermore, with the German terror gone, there is a plethora of warships, a positive embarrassment of riches. Great Britain, who started the war with 2,500,000 tons of warships, finds herself at its close with a greater navy than she now needs. If Mr. Daniels positively must have his 32 capital ships, the Allies, in their desire to prevent friction in the family, might prevail on Great Britain to let him have a round dozen or so of her own, say at half price, and then the Allies might throw in the German ships to make up the full quota.

When our navy was weak and while we saw the dark cloud arising on the world horizon, none was more earnest in the advocacy of a powerful United States Navy than the SCIENTIFIC AMERICAN. We claimed then that our Navy should stand second in strength among the navies of the world. We gained that position in 1904 and then, thanks to the German war pace-making, we fell behind. Today we have regained the place. The German menace is gone, we believe forever. For the future our policy, with that of Great Britain and of all the champions of peace and brotherhood, should consist in building ships merely at a pace that will make good the losses due to depreciation through age of the older vessels. At the most, we should complete our program of 1916. To double it in this hour of retrenchment and conciliation would be preposterous.

Using the Planes

THE Wright brothers said, in 1905, that they had no objection to the trees that studded their practice grounds, because "learning to dodge them will make us better flyers." From 1914 to date air-defense guns and aerial fighting have done for flying exactly what the trees near Dayton did ten years earlier, while the development of aerial bombing has forced airplanes to carry immense cargoes. It is purely as a result of all this that we are now able to establish aerial mail service, running on schedule and maintaining that schedule; it is wholly because of the great advance made under the lash of wartime necessity that the airmen of all nations dare set their hearts on the immediate employment, in commercial pursuits, of the teeming multitudes of perfected planes.

After the technician has had his innings, however, the business man takes the floor; so there remains unsolved, and even in large measure unattacked, the problem of demonstrating that commercial flying could be made to pay. But there is good ground for hope that the business man will not be quite so far behind the engineer here as he sometimes has been in other fields. There is even an excellent prospect that the commercial aspect of the problem will be solved automatically, just as were the technical features.

A serious danger of famine has arisen in central Europe, where a mere relaxation of the rigid food control maintained during the war would seem to carry the threat of disaster. It seems highly significant that simultaneously with the appeal for aid against this peril came the report that the Italians are successfully using bombing planes and dirigibles in supplying starving Austria with food. Where would we look for the first step in this direction if not to this race which has ever shown itself to be foremost in the possession of that directed imagination without which the technical man can never hope to rise to the highest level of creation?

Aerial transportation has its obvious undoubted limitations; but to offset these it possesses one paramount factor of advantage; it requires a minimum of organized effort. The aerial highway exists everywhere and leads everywhere; it can never be blocked by accident nor obstructed by congestion of traffic. In central Europe, the country that knows no fences, landing and starting grounds, the sole demand that the aviator makes upon the surface features, are everywhere: except for the sparsely scattered fruit trees, the meadows and fields offer continuous expanses of bare, smooth, firm ground for the aviator's use.

In a pacified country aircraft have unlimited radius of action; they can break ground for their own operations by establishing such gasoline stations as may be necessary. By concentration of the rural population in compact villages, and by taking due advantage of the abundance of public squares and parks in the old world cities, aerial food transport can be brought within walking distance of everybody. The speed and the climbing ability developed by four years of war make even the small scout plane available, because so far as the mechanical end is concerned, this development means the same thing as weight-carrying ability at low speed and low altitude. And the bombing planes and dirigibles would for similar but even more obvious reasons constitute the most admirable cargo "ships" for the uses of peace times

The outstanding limitation of aerial transportation is the capacity of the planes and balloons, which, however surprising it be, for planes and balloons, is after all rather contemptible when we compare it with the big ship or the railroad train. But the high speed and the directness of route, now that aerial transit has become reliable, makes up for the limited capacity of a single plane, as we see daily illustrated in the life of the birds. A nightingale carries only one or two stalks of grass at a flight, yet its nest grows rapidly and soon represents quite a weight

A railroad exists only by virtue of the perfection of organized coöperation; aerial transportation loses not one jot or tittle of its efficiency under the most chaotic of conditions. The airplane, the most intricate of vehicles, has made the problem of supplies once more as simple as it was for the Indians; it affords direct and individual transport from producer to consumer.

The Public Health Service Reserve

WHILE the country was uproariously celebrating the end of *the* war, the bystander of a philosophizing turn of mind felt his enthusiasm tempered by the realization that, while one war was finished, another was and long will be still in progress. The guns are silent; bombs no longer hurtle from the sky; men no longer asphyxiate one another under official auspices; murder on the high seas is no longer an every-day occurrence. But human beings still suffer almost every conceivable torment, and Death still holds carnival throughout the world.

It is hard to make people actively aware of the fact that every nation under the canopy of heaven is perpetually at war with disease and death, and that the human toll of this eternal war is vastly greater than that of any conflict of arms. If this fact were but keenly realized, should we not have appropriate measures taken by the powers that be? Should we not behold the people of the United States, for example, mobilizing, holding mass-meetings, contributing to super-Liberty loans, working for the Red Cross in time of so-called peace; duplicating, in short, the activities of the past year in defense of their firesides against a foe not domiciled across the Atlantic Ocean, but present at their very doors?

In the recent epidemic of influenza the United States Public Health Service was called upon for a far greater measure of service to the nation than it was able to render. This onslaught of the Grim Reaper (to borrow a phrase from the fledgling reporter's vocabulary) found the country *unprepared*. The Health Service did well, under the circumstances. An emergency appropriation of a million dollars was rushed through Congress. The Volunteer Medical Service Corps furnished a list of a thousand physicians, classified by states, to whom temporary appointments were offered by telegraph by the Public Health Service; the American Medical Association helped secure doctors; the medical journals published appeals. Some nurses, though far too few, were obtained with the aid of the American Red Cross. All these measures, however, savor of improvisation; and a newly arrived Martian would certainly gain the impression from the recent occurrence that no great epidemic of disease had ever before visited our nation. Otherwise (we may suppose the enlightened stranger saying to himself) these Earthians would have had the defensive machinery all ready to set in motion, as soon as the danger loomed on the horizon.

This is an era in history when hints are promptly taken by the once ponderously deliberate minds which regulate public affairs. A joint resolution establishing a reserve of the Public Health Service, analogous to the reserve forces of the Army and Navy, had been pending in Congress for more than a year. Thanks to the object-lesson above mentioned, this resolution was hurriedly brought forth from its pigeon-hole, passed by both Houses, and approved by the President on October 27th. Under this act suitable persons are to receive commissions of various grades in the Public Health Service for a period of five years, but will, as a rule, be called into active service, with pay appropriate to their grades, only during times of national emergency, and probably for brief terms of training at other times.

The fact that this new corps of reservists will be far more valuable to the nation than the Army and Navy reserves will perhaps be recognized by our grandchildren. The present generation is still too much under the influence of distorted views regarding the proper place of militarism in a scheme of national defense. It is a pity these views cannot be dissipated at once. One result of saner thinking would be that such organizations as the American Red Cross would not retrench their work for suffering humanity on account of the signing of a "peace" treaty. Another would be that the military man would no longer enjoy a monopoly of brass bands, liberal pensions and hero-worship, to the deprivation of the equally worthy or worthier fighters against disease, crime, fire, ignorance, and the other ills that afflict the human race more persistently than what is commonly called "war."

Industrial Efficiency

Economic Program in Spain.—In connection with the renewal of the charter of the Bank of Spain, which expires in 1921, a commission has been appointed by the Spanish Ministry of Finance to draft a new bill and at the same time to work out a comprehensive economic program, which includes (1) the purchase of the railroads and their operation by the State; (2) the utilization of the waterfalls for motive power; (3) a special mining law providing for the participation of the State in "extra profits"; (4) the creation of a national industrial bank; and (5) the rebuilding of the nation's industries.

Coke and the Coal Shortage.—Seventy per cent more coke than ever before will be available this year to help solve the fuel shortage, according to *Electrical Review*. This supply will be further increased by the development of tar, coke-oven gas and other by-products newly dignified in wartime as available fuels. Pulverized coal to attain the greatest efficiency is also a subject that is interesting fuel men just now. Some of the advantages of pulverized coal are: The utilizing of every heat unit in the coal; the reduction of labor for handling coal; and the maintenance of a constant temperature in the furnace.

Production of Rubber in Fiji Islands.—According to a published statement of His Majesty's Trade Commissioner to New Zealand, who has lately visited the Fiji Islands, the rubber industry is receiving much attention in those islands, and New Zealand farmers have planted large plantations there that have produced quantities of rubber reported to be of a very high grade. It is claimed that there are thousands of acres in the Fiji Islands that are well adapted to this industry, and it is expected that extensive developments will follow. The price of rubber at present seems very low, since the market is so greatly restricted because of the war, but it is expected when normal conditions are restored that this will become a profitable industry in these islands where labor is comparatively cheap.

Notable Salvage Work.—The annual report of the superintendent of the Cleansing Department of Glasgow, Scotland, as recently published in the press, shows that for the year ending May 31st, 1918, the disbursements amounted to $1,184,500 and the revenue to $317,250, making the net cost of the department $867,250. The average quantity of refuse dealt with per working day was 1,104 tons, as compared with 1,173 tons in 1916-17. The decrease seems to indicate that the appeals to the citizens to assist the department by reducing, as far as possible, the quantity of refuse to be removed were not barren of result. The refuse was disposed of in various forms. Waste paper amounted to 1,103 tons, and the record sum of $44,965 was obtained from its sale to contractors. The total revenue derived from waste materials during the year was $62,345.

"Made in U. S. A."—At a recent meeting of the executive committee of the Merchant's Association of New York, the following resolution was adopted: *Whereas*, we believe that the best interests of our country are served when all goods manufactured here can be readily identified at all times from goods manufactured elsewhere; and *Whereas*, we believe that the identification of the country of origin of any goods is facilitated by the use of a single designation of origin and *Whereas*, we believe that the designation "Made in U. S. A.," in plain type form, is the best means of identification of goods manufactured in the United States of America: Therefore be it *Resolved*, That the Merchant's Association of New York recommends that the designation "Made in U. S. A.," in plain type form, be used by all its members on all goods manufactured by them in the United States of America, and that the use of all other markings to identify the country of origin of such goods be discontinued.

The Future of Germany's Potash Trade.—It is pointed out in Dutch journals that the German potash industry, heretofore almost a monopoly, may have to face severe competition after the war. Potash deposits have been discovered in Catalonia, Spain; potash will probably be mined in the Netherlands (in the concession field of Winterswijk); the United States may develop a potash industry. Under the stress of competition the German mines would undoubtedly combine so that only one out of four or five mines would remain in operation. But the closed mines would still require considerable sums for the upkeep of buildings and machinery; water must be pumped out to keep the mines dry, as it might otherwise flood the neighboring mines, etc. The earnings of one mine would have to be distributed among the owners of four or five mines; and, if prices were to fall, the shareholders would have to be contented with meager dividends. The German mines charge their foreign customers higher prices than the domestic consumers pay and, owing to the enormous sums invested, high prices of potash are a vital condition for the existence of German potash industry. Hence the German interests are bound to keep the prices high and will not lower them save in case of extreme necessity.

Science

A Commission to Study Influenza was appointed by the Governor of New York, October 22d. The surgeons general of the U. S. Army, Navy and Public Health Service have been invited to serve on the commission, which includes in its membership some of the leading official and unofficial medical men of New York State.

The Largest Automatic Telephone Exchange in Europe was opened at Leeds last May by the British post office department. The exchange is equipped for 6,800 subscribers, and will ultimately have a capacity of 15,000. All switches are worked by a storage battery at the exchange. No fewer than 26,000 wires enter the building. The British post office has now installed automatic exchanges at a number of towns. The manual instruments displaced by the new device are utilized in war service at the front.

In Defense of the White Ant.—Residents of tropical regions generally look upon the white ant as an unmitigated nuisance, on account of the damage wrought by this insect in all kinds of woodwork. It appears, however, from Sudan Notes and Records, that in the Sudan, at least, white ants serve a useful purpose. Vegetation grows very rapidly during the wet season and the ant only attacks plants that are weakened by drought or disease, and that, but for the activities of the insect, would soon cover the fertile parts of the country with an impenetrable mass of vegetable refuse.

Rising Level of Lake Nyasa.—In view of all that has been written on the progressive shrinking of bodies of water in Africa and elsewhere, it is interesting to learn from the *Geographical Journal* that since 1915 the level of Lake Nyasa has been rising, after a continuous fall of many years. The low-water level of the lake at the end of the dry season in 1917 was 3 feet 10 inches higher, and the high-water level at the close of the rainy season 3 feet 5 inches higher, than they were at corresponding dates in 1915. The Shire River at its exit from the lake is still unnavigable, except for barges, but this is due to the growth of weeds and silting-up that occurred during the years when the lake was falling.

A Gun That Will Shoot Into Space.—In a detailed scientific discussion of the German long-range gun which bombarded Paris last spring, Major J. Maitland-Addison, writing in the *Journal of the Royal Artillery*, takes a peep into the future and considers the possibility of a gun capable of shooting projectiles entirely off the earth into space, a la Jules Verne. The requisite velocity of such a gun is not, he says, so very much higher than what has already been achieved; viz., a muzzle velocity of a mile per second. When we are able to increase this to five miles per second, the projectile, if fired at a suitable angle, will travel around the earth as a grazing satellite, completing its orbit between 17 and 18 times daily. With a velocity of about seven miles a second, it will move off into space, never to return.

The Alleged Rediscovery of the Passenger Pigeon.—The North American wild pigeon, or passenger pigeon (*Ectopistes migratorius L.*), once so exceedingly common in this country that flocks of more than two billion birds have been seen, is now generally believed to be extinct. What was supposed to be the last survivor died in the Cincinnati Zoölogical Gardens, in the summer of 1914. The rapid disappearance of these birds is a mystery, hardly explained by their ruthless slaughter at the hands of man. According to a letter published in *Science*, Messrs. Rasmussen, Wilson and Sanders, of Amsterdam, N. Y., encountered a flock of passenger pigeons on October 1st, 1918, while on a bird-study trip in the vicinity of West Galway and Charlton, N. Y. One of the birds lighted within a few feet of the party, and Mr. Rasmussen, who has been studying birds for 25 years, declares that there is no possible doubt of the identification.

A Remarkable Journey in Alaska was performed last winter by Archdeacon Stuck, already well known for his ascent of Mt. McKinley. His route extended around the whole arctic coast of Alaska, beginning at the west side, and thence inland to Ft. Yukon. He was received everywhere with cordial hospitality by the Eskimo. Two weeks were spent at Point Barrow, where the traveler had an opportunity of studying the largest Eskimo village in Alaska under winter conditions. During the subsequent journey of 250 miles to Flaxman Island the party saw only one human being and were housed only twice. The archdeacon describes it as "the barrenest, most desolate, most forsaken coast I have ever seen in my life; flat as this paper on which I write, the frozen land merging indistinguishably into the frozen sea; nothing but a stick of driftwood here and there, half buried in the indented snow, gives evidence of the shore." For two weeks the travelers had to face a bitterly cold northeast wind, and the faces of all were continuously frozen. The heaviest task of all was the journey over the winter's unbroken snow to Ft. Yukon. On this inland trip Stefánsson and his party were encountered and escorted to Ft. Yukon, where Stefánsson, who was seriously ill, received medical attention.

Automobile

Gas as a Fuel.—Experiments in England with ordinary producer gas as a fuel for internal combustion engines has shown that as the size and power of the engine increase the loss on producer gas diminishes. The fact that coal gas, although of lower calorific value than gasoline, gives better results is accounted for by the pressure of the gas in the bag which delivers this fuel to the engine with little or no "back pull."

Air Leaks.—A defect in the engine that is usually ignored is an air leak which prevents efficient regular operation. These leaks may be at the joint of the cylinder head, around the spark plugs, past the piston rings, or the valves may not be tight all of which would lower the compression and power. Others may occur around the valve case or the joints of the intake manifold, which would occasion irregular ignition. It pays to guard against these defects.

The Man Who Takes a Chance.—Too many drivers of cars are obsessed with the idea that they own the earth, and nowhere is this so apparent as in their procedure when they approach a railroad crossing. A western railroad made observations of 20,000 drivers at crossings, which are summed up as follows: 525 drivers smashed through the crossing gates when the gates were down and bells were ringing; 69½ per cent of the 20,000 drivers looked neither to the right nor left; 27 5/10 per cent looked one way along the track while going at reckless speed; 2 7/10 per cent took pains to look both ways. Only 35 drivers out of the 20,000 stopped their machines before crossing the tracks to make certain that no trains were approaching. The unfortunate thing about railroad accidents is that the reckless driver usually escapes, and his helpess passengers are the victims.

Exhaust Gas Poisoning.—With the advent of cold weather it may not be amiss to again revive the oft-repeated warning against running an automobile engine in a closed garage; although it is not likely that it will do much good, as there are always people who, if not entirely ignorant on the subject, will take a chance. The difficulty appears to lie in the impossibility of impressing a realization of how very little of this exhaust gas is necessary to produce fatal results, and inability of many people to understand that a gas that they cannot smell is dangerous. The gas you smell is that of incomplete combustion and from burnt oil; but the most dangerous gas has no odor, and the more perfectly the engine operates, the greater the quantity of the deadly gas. How dangerous it is may be appreciated from the fact that an amount as small as one-twentieth of one per cent in the air breathed is sufficient to produce poisonous results.

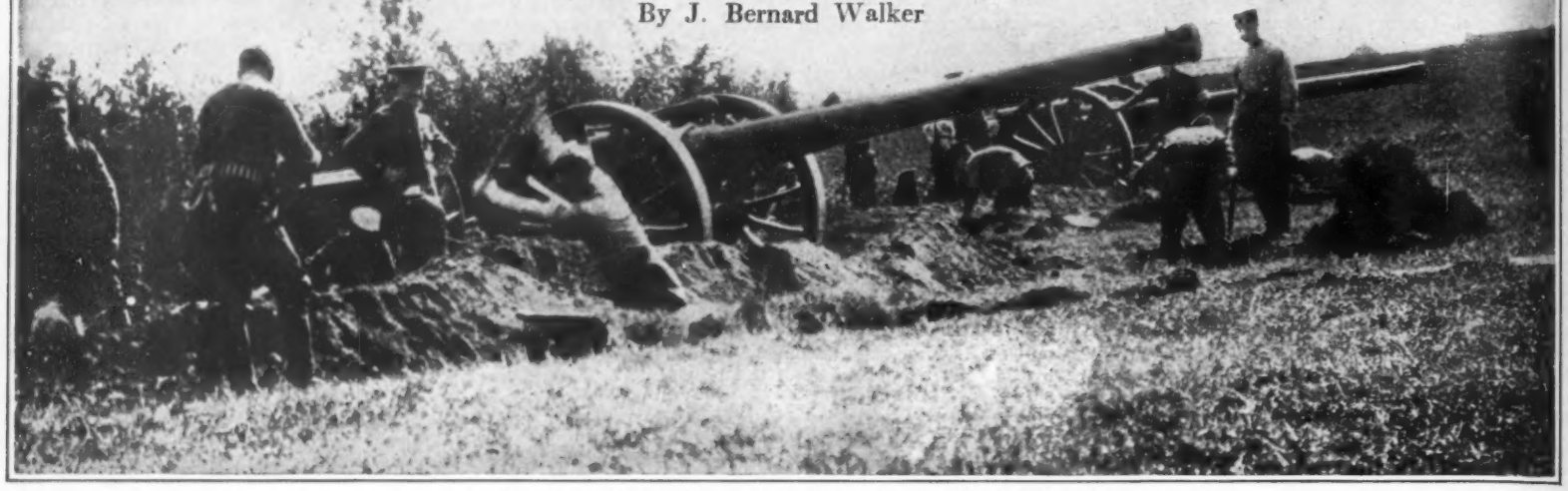
Engine Efficiency.—As excellent as our automobile engines now are some engineers do not hesitate to say that they are far from as efficient as they should be, and might be, in the use of fuel. If improvements can be effected in this direction they will be duly appreciated; but the question arises whether the perfected engine will require any more skill to operate it than the present types. A favorite statement of manufacturers has long been that their designs are "fool-proof," and while this expression is not very complimentary to their customers, it, in fact, covers a considerable percentage of the driving public; and the splendid record of the modern car bears witness to the truth of the makers' claims. There are undoubtedly many engineers who already know how to build a better engine, but are deterred from the attempt by the fear that they would not be properly handled. On the other hand, the very reliability of the modern engine makes the average owner indifferent to all technical problems of operation, and even to the proper care of their machines.

The Rights of Pedestrians.—A Massachusetts judge has decided that the rights of an automobile driven on a public highway are not superior to those of a pedestrian, and this decision will probably have an important influence in many future damage suits in the courts. While this may have been sound law a hundred years ago, times and conditions have changed since, and there is no doubt but that the dictum will be considerably modified at no late date, and will hasten the settlement of a problem that has constantly become more pressing. The decision was rendered in an accident case where the defendant was guilty of a more than ordinarily truculent operation of his machine, with evident indifference to the rights of every other user of the road, and the circumstances of the case undoubtedly influenced the sweeping decision of the judge. It is unquestionable that, as cars have become more numerous, they have practically monopolized the roads, and seriously infringed on the rights of the public; and as a matter of fact, even the little car has to give way to the big one. On the other hand, the pedestrians should not stray in the open road at will, particularly where side paths exist. But "car dodging" has become monotonous, and the respective rights, and particularly the duties, of each party should be equitably determined at an early date.

Great Britain at War

Our Ally's Stupendous Effort with Men, Money, and Munitions, in Air, and on Land and Sea

By J. Bernard Walker



On the Western front—Throwing up earthworks around a British battery

SPEAKING recently of the magnitude of Great Britain's share in the winning of the war, Mr. Otto H. Kahn drew attention to the fact that it was a British characteristic not to indulge in self-advertisement, and that it was due largely to this that the magnificent war record of the British Empire had not received adequate recognition. With a view to placing the facts before the American public and giving due honor to Britain's achievements, an organization of Americans, with Alton B. Parker as chairman and Dr. Charles W. Eliot as honorary chairman, has planned a special day of tribute, December 7th, 1918, which will be duly observed in New York and over six hundred cities throughout the country.

During the course of the war, the SCIENTIFIC AMERICAN has kept its readers in touch with the technical developments in all the countries and on the various fields of battle. The present article is an attempt to visualize the vast contribution of Great Britain to the final and glorious success of Allied arms.

The Army

In August, 1914, the British army contained 250,000 regular troops, 200,000 reservists, and 250,000 territorials (the old volunteers). By the middle of August, two weeks after the outbreak of war, she placed her first expeditionary force of 160,000 men in France. At once Lord Kitchener called for volunteers, and the country bent itself to the task of building up an army to meet the mighty forces of the Central Empires. A year later, or July 31st, 1915, 2,000,000 men had enlisted in the army, and ten months after that, on May 25th, 1916, the Government announced that the total voluntary enlistment in the army and navy had reached 5,041,000. In August of the present year, Lloyd-George announced that there was a grand total of 8,500,000 men serving in the army and navy of Great Britain.

As the war progressed German and Irish propaganda was quick to take advantage of the prominence which was given in the press to the achievements of the troops from overseas—the Canadians, Australians, and New Zealanders—by suggesting that England, as usual, was sitting back and letting other people do the fighting for her. The following official statistics show how England held back:

	Per Cent Armed Forces	Per Cent Casualties
England and Wales..	70	76
Scotland.....	8	10
Ireland.....	6	6
Dominions and Colonies.....	16	8

During the four and a half years of war, Great Britain has waged altogether seven different campaigns, and thanks to her omnipresent navy, she has been able to attack and defeat the enemy in no less than 18 different centers on the globe. British forces have fought in the following localities: Flanders, France, Italy, the Balkans, Egypt, Mesopotamia, Aden, Persia, Palestine, the northwest frontier of India, Kiaochau; Siberia, Northern Russia, New Guinea, Samoa, the Soudan, East Africa, West Africa, and Southwest Africa.

The above list is the answer to the German cuckoo cry, "Where are the English?" We are now permitted to state that of the total of 8,500,000 fighting men, over 4,000,000 were serving this year in France, over a million in Mesopotamia and Palestine, and the balance in the navy and in the various centers throughout the world, that are enumerated above.

Night picture showing transport bringing up ammunition

Perhaps after all, the supreme test of a nation's share in an allied war is the casualty list—the dead and wounded. Judged on this basis we find that in the whole British Empire, 1,000,000 men died in battle, and by accident and disease, and today lie in a soldier's grave. Based on a ratio of three men wounded for one killed, the British casualties amount to over 3,500,000.

We in America, who know what grief has come to us, due to some 53,000 deaths and 236,000 casualties, can appreciate the price that was paid by the British Empire with its death roll of over 1,000,000 and its casualty list of over 3,500,000.

Perhaps the most brilliant feat of British arms was the rescue of Mesopotamia and Palestine from the Turk, and the utter annihilation of the Turkish armies in the field. The greatest battle of the British armies began on October 8th, which Frank H. Simonds designates as the "decisive day," when Foch threw three British armies against the Hindenburg Line between Cambrai and St. Quentin, with the result that they broke entirely through the wide stretch of those amazing defenses. During these weeks of continuous fighting, the casualties were from 35,000 to 40,000 a week.

The official figures showing the total captures of the British army to date are not available at the present writing; but several weeks before the signing of the armistice, the total of prisoners taken on all fronts was over 400,000, of which nearly 300,000 were German prisoners. The total number of guns captured is estimated at over 4,000; the majority of these were taken from the Germans in France and Flanders.

British Aircraft

One of the most brilliant pages in the history of the army in the great war is that covering the aircraft forces. In 1914, the amount of bombs dropped by aircraft was practically nil. In May, 1918, 668 tons were dropped in a single day. On the western front, British aviators silenced 127 German batteries, destroyed 28 gun emplacements, and caused 60 explosions in ammunition dumps, etc. In one week in August, British aviators accounted for a total of 334 enemy machines and one Zeppelin. From July, 1917, to June, 1918, 4,102 enemy machines were destroyed or brought down by British pilots, with a loss of 1,213 machines.

British patrol entering Cambrai in the wake of the retreating Germans. Note the smoke and dust of shell fire

The Navy

It is a common truism accepted the whole world over, that but for the preparedness and power of the British fleet, Germany would have succeeded quickly in her monstrous attack on civilization. The work of the navy has been summarized as follows:

1. The High Seas Fleet of Germany, costing her $1,500,000,000 was contained in its home ports.

2. Five million five hundred thousand tons of German shipping and 1,000,000 tons of Austrian shipping was driven off the seas or captured.

3. The overseas trade of Germany and Austria was strangled.
4. The German Overseas Empire was torn from them.
5. Two million enemy subjects of military age abroad have been prevented from joining the enemy.
6. Ocean communication with the markets of the world has been denied to the enemy and secured to the Allies.

The situation which the British navy established within 24 hours, remained unchanged to the close of the war.

During this war British warships have fought in every sea, either against enemy ships or to support the Allied troops in land operations. It is officially announced that, in proportion to numbers serving, the casualties suffered by the British navy are higher than those in the army.

Battleship evolutions at full speed in the North Sea

In August, 1914, the British navy had a tonnage of 2,500,000 and a personnel of 145,000 officers and men. Today it has a tonnage of 8,000,000 including the auxiliary fleet, and its personnel has increased to more than 450,000 officers and men. This does not include those in the Mercantile Marine, over 12,000 of whom have given their lives for the cause of the Allies. In 1914, mine-sweepers and patrol boats numbered 12; they now exceed 3,300.

During the first four years of the war, the British navy transported across the sea over 13,000,000 men, 2,000,000 horses and mules, 500,000 vehicles, 25,000,000 tons of explosives, 51,000,000 tons of oil and fuel, and 130,000,000 tons of food and other material for the use of the Allies. Every day of the year during the fighting in France and Flanders, the navy carried from England 7,000 men and 30,000 tons of military supplies, and last April to make good the loss from the German drive, she carried from England to France in 30 days, 355,000 men. To date, the Royal Dockyards have docked and repaired during the war over 40,000 vessels, in addition to doing extensive repairs on Allied ships.

Because of its terrible threat to the boys on our transports and because of the coöperation of our destroyers and patrol boats with Great Britain, Americans have been particularly interested in the anti-U-boat warfare A statement made public shortly before the close of war showed that of the Allied warships engaged in anti-submarine warfare in the East Atlantic, 80 per cent were British, 14 per cent American, and 6 per cent French.

Of the submarines engaged in hunting submarines, 70 per cent were British, 17 per cent French, and 5 per cent American. Of the miscellaneous smaller patrol craft, largely extemporized yachts and motor boats, 86 per cent were British, 11 per cent French, 3 per cent American. The bulk of our craft of this type was engaged in protecting our own coast.

British warships during their silent watch in the North Sea and other home waters, travelled in one month 1,000,000 sea miles. In the same month the mileage of auxiliary vessels, including mine sweepers and patrol boats was 6,000,000 miles. In the anti-submarine warfare, over one-hundred and fifty German U-boats have been destroyed. British submarines have been uniformly successful, destroying two battleships, two armed cruisers, two light cruisers, seven destroyers, five gunboats, 20 submarines, and five auxiliary vessels, besides badly damaging three battleships. The submarines also destroyed 14 enemy transports, six ammunition and supply ships, and 250 steam and sailing ships and in this work no merchant ship was sunk at sight, and care was taken that the crews got safely away.

The Merchant Marine

At the outbreak of the war the tonnage of the Merchant Marine was 18,750,000, manned by 200,000 officers and men.

On the British Merchant fleet has fallen the great task of supplying with food, coal and other material, not only the far-flung British Empire, but also the great majority of the people of Belgium, France, Italy, Servia, etc. Over 1,500,000 tons was set apart for the service of France, to whom 2,000,000 tons of iron and steel was supplied in one period of 18 months. Of France's imports 45 per cent, and 45 per cent of Italy's, were carried in British ships, and 50 per cent of their coal was supplied by Britain and carried in her ships.

Due to the fact that it has been the great carrier for the Allied cause, and has fearlessly traversed the submarine zone, the Merchant Marine has lost over 9,000,000 tons, or say 50 per cent of its original total.

Five million British women engaged in work formerly done by men. These two are testing mines

In carrying on against the ferocious submarine warfare, the 200,000 officers and men, despite the loss of 12,000 seamen and 15,000 non-combatants, have shown undaunted heroism. The President of the Board of Trade reported in the House of Commons (May 15th, 1918), that there had not come to his attention a single instance in which either officers or men had failed to take out their ship when it was ready to sail.

The tonnage entering and clearing United Kingdom ports rose from 6,336,663 tons in January, 1918, to 8,158,639 tons in August, 1918.

The losses through submarines were offset by new construction and requisitions to the amount of about 4,250,000 tons. By the release of shipping due to the increased production of food in the British Isles, the total increase of tillage since 1916 amounting to 4,000,000 acres, there was a corresponding saving of the service of 2,000,000 tons of shipping.

British Women in the War

In 1914 out of a total population of 44,000,000 in the British Isles there were 18,000,000 workers. Of these 6,250,000 joined the fighting forces and 4,000,000 went into munition and other war work, leaving only 7,750,000 of the original 18,000,000 to carry on the trade, etc. of the nation—and they did it, thanks to the patriotism and ability of the women of Britain.

In 1914 there were 200,000 female workers. In 1918 over 5,000,000 women were doing 1,701 different kinds of work formerly done by men.

The following table includes only a part of these activities of the women:

Munitions	1,000,000
Engineering and chemical trades	500,000
Farm laborers	300,000
Army and Navy Service	30,000
In Government offices, etc.	500,000

The munition output, to which the women so largely contributed, not only supplied the whole British army but was able to furnish large amounts to the Allies. In 1918, the output had risen to 12,000 tons per day.

As Banker for the Allied Cause

In addition to holding the seven seas secure and maintaining an army of 8,150,000, Great Britain, as Lord Curzon stated on July 29th, 1918, "has been the feeder, clothier, armorer, banker and universal provider for the Allies." Previous to our entrance into the war she had loaned to the Allies the huge sum of over $8,000,000,000.

During the war the National Debt has risen to $42,000,000,000. The taxation, which in 1914 was about $1,000,000,000, in 1918 has risen to $3,270,000,000. The response to the Government Loans has been well distributed; for out of 44,000,000 people some 19,000,000 have invested in the War Bonds and War Savings Certificates. At the opening of the fourth year of the war, a popular Victory loan of $5,000,000,000 was raised in 30 days. Since that time, the great drives for money have been abandoned, and the people contribute a steady flow of about $125,000,000 per week.

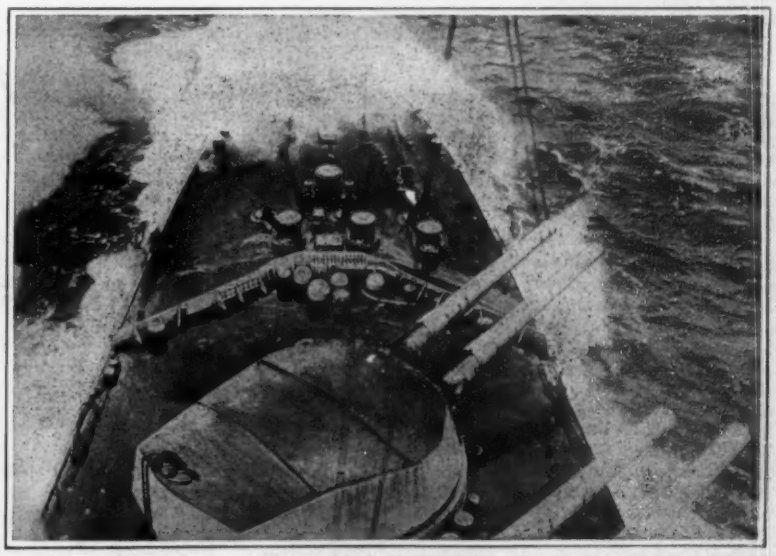
* * * * *

The foregoing is at best but a skeleton outline of the contribution of the British Empire to the vast Allied operations, which have resulted in the overthrow of the foulest and most stupendous effort ever aimed at the security of modern civilization.

New Idea in Potato Growing

IT is rather curious that practically all over the world the gathering of the potato crop is carried out in conjunction with the destruction of the plant. Lately it has been proved that an enormous increase in the yield may be ensured if the plan of picking the potatoes is adopted. Some interesting tests on the following lines were made in England, with astonishing results. When the potato plants had grown to a fair extent the largest tubers that could be discovered were grubbed up. These were located and taken with as little injury to the roots and shoots as possible. A second gathering of tubers was made after about another month. It was noticed that, after the tubers had been picked, the plants started to grow with a renewed vigor.

Admiral Rodman, U. S. N., visits Admiral Beatty on his flagship "Queen Elizabeth"



The Grand Fleet—forward guns of a dreadnought

The Farm Accounting Problem

A Practical Scheme by Which the Farmer Can Know Where He Stands Financially

By Edgar L. Smith

SOME one aptly remarked that considering the amount of talk about the weather it's a wonder no one ever did anything about it. Talk, talk, talk, but no action!

This is the way many feel about the farming situation. Everyone complains about inefficient farming methods but no one seems to be able to offer any practical solution. The great cry has been "apply business methods to farming" forgetting perhaps that farming is not only a business but also an art and a science—occasionally a pastime. In its aspect as an art it is as difficult to apply business methods as it would be to standardize portrait painting under the guidance of an efficiency expert or a certified public accountant. However, with certain reservations, farming, under the constantly increasing use of machinery, is becoming mainly a business and less an art; so it can profit by the experience of other industries which have only attained their high development through certain well defined business principles. Perhaps the most important of these is the keeping of accurate records of the main factors upon which success or failure depend, analyzing these records and basing future plans upon the recorded experience of the past modified by the best judgment obtainable.

The ancient and greatest of industries has been the last to recognize the advantage of the business methods that have been developed in the newer upstart industries of manufacturing, transportation and distributing. Farming, the backbone of our prosperity, of our very life, has been slow to break away from its great traditions, the traditions of the skilled husbandman who learned the art of farming from his father, and from his father's father, each succeeding the other upon the same or nearby lands, every inch of which they knew as only he can know a tract of land who has been born and raised on it, has heard the story of its past, has watched the crops follow upon each other in the round of years—some bountiful, others scant.

This has been the ancient tradition of agriculture, and still was in parts of the old world until the war put an end to the normal conduct of every peaceful pursuit. In the new world, a new tradition became established, the tradition of farming great areas of virgin soil, exhausting them and moving on to new land. A rough and ready farm practice grew up and flourished unhindered by any economic pressure. Both of these great traditions have been overturned by the Great War.

What is Wrong with Our Farms?

We need not concern ourselves at once with agricultural problems of the old world for our own problems are many and great. Even before the Great War, economic pressure was making itself felt upon the farmer. New areas of fertile land could not be had for the asking. The pressure of population drove the price of good land so high that fixed charges became a burden—reducing the margin of profit and lowering the standard of living to a point where the native American farmer has been displaced in many localities by the foreign-born willing to adopt a lower standard while the natives went into city industries.

There had been a constantly increasing exodus from the farm right up to the opening of the war. The war came at a time when farming was groping for the answer to its many problems, and it disturbed all the factors upon which American farm practice had been based. It has done the same with other industries; but in the case of other industries, it found them organized—those engaged in them had figures based upon accurate records with which to defend themselves against encroachment and ruin through unwise laws and regulation.

In dealing with the most important industry of all—farming—the law-makers have nothing to go by, no real data. When they try to establish a fair price for milk, for wheat, for potatoes, it is the middleman, the distributor who presents the figures and tells what the farmer should get. The farmer has no figures. He has kept no books, he has no evidence to present before the court of public opinion to defend himself against those from whom he buys his supplies and from those to whom he sells his products.

They keep books—oh, yes; they know that they could not stay in business a year if they did not. And now the farmer is awake to the advantages that are not his because he has not followed what has proved the only plan upon which a really successful business can be built up. Every successful business today has progressed through a constant knowledge of where it stands financially and a careful analysis of records which show where its profits come from and where it is sustaining losses. It is through constant vigilance, made possible only through intelligent records, that undue losses are forestalled and disaster avoided.

It is not only in this broader sense that farm accounts benefit the farmer. These general benefits will be derived only as the great majority of farmers keep accounts and keep them upon some standardized system that will make it possible to draw accurate conclusions from a mass of data assembled from a large number of farms. If these remote blessings were all that a farmer could expect, the task of persuading him to break with tradition and become a business man in the modern sense would seem hopeless. But the first benefits will come right home to each farmer personally who gets lined up right on the proposition.

FARMING is becoming ever more a business and less an art. But it has been the last industry to recognize the advantage of business methods. The farmer doesn't know what he is worth, what his income is, what his costs amount to or what they are for, where he is making money and where he is losing it, what it costs him to live, how much he must make to break even. He can neither buy nor sell nor borrow nor pay taxes with any secure knowledge that he is getting what he should get or giving only what he should give. He believes that he can not keep books, and in this belief is probably right. But—there is a way out, and this story points to it.

Farming as a Business

In the first place, his standing at the bank will be improved 100 per cent. Any banker will lend more freely to a man who can show a set of accounts. A great deal has been written about the inadequate credit facilities of farmers, but where, pray, is the merchant or manufacturer who can borrow money with no balance sheet, no inventory, no profit and loss statement to show his banker?

When a farmer keeps books, his credit will take care of itself up to the point that his enterprise deserves. Farm accounts solve the credit problem.

But more important than credit, is the question of profits. Farm accounts, properly designed, bring promptly to light those losses and leaks which if allowed to run, will eat deep into profits if they do not swallow them whole.

Then there are the experiments—the small ventures that every farmer undertakes. It is of the utmost importance to know in dollars and cents just what these amount to, and to know their proper relation to the rest of the farm operations. Costs and profits estimated for one department alone are often misleading. Get costs accurately—but fit them in with the costs and profits of the whole farm. Only in this way will the result be dependable. If this is done intelligently, it is often safe to expand a successful small venture rapidly into a main source of revenue. Complete figures give confidence, and rightly so.

Then there are the dealings with the creamery. If a group of farmers have accurate and complete figures to show that the price they get for their milk is too low, the creamery is bound to listen. They know that it is to their interest to have the farmers in their section prosper. But if everybody is guessing, they will guess with the best of them and will probably guess low.

These are some of the benefits of accounts and cost records; but they are not the every-day, year-in-and-year-out benefits. The greatest expense items in farming are the labor costs—man labor and horse labor. Nothing calls for closer study than the problem of finding the best distribution of man hours and horse hours. An analysis of these items every month and at the end of the year by a thoughtful farmer will point the way to the saving of many dollars; by arranging the balance between acres, live stock, rotation and man-power so that the men put in the highest possible percentage of their time in profitable work and the horses are kept busy the largest number of hours throughout the year *earning money*.

Next in importance is the matter of feed, both for work animals and other live stock. Feed prices are constantly changing and it is the man who knows just what it is costing him to keep his stock, and the cost of each item in the ration, who is in the best position to change his feeding practice in response to these changing conditions, and make a profit.

These are only a few of many ways that a farmer can improve his farm management and his profits by the careful study of accurate records intelligently analyzed. Others will occur to every farmer. But today there is still another reason why every farmer must keep account, and that is the income tax report that he must file.

To make this out he must keep accounts of some kind and the time is ripe therefore to help him keep a set of records that will not only meet the income tax requirements but will also point out to him, along the lines suggested above, how to organize his business, obtain better credit at the bank, and make larger annual profits, all through the intelligent use of practical records sensibly analyzed.

"It Can't Be Done"

Every business man will accept all this as axiomatic and most up-to-date farmers will agree that it would be a good thing, but they will add: "Have you ever tried to keep a set of books on a farm, making your records after a hard days' work in the field?"

And right here is the stumbling block. Farmer's can't keep books. There is no argument about this. Any system of farm accounts that calls for bookkeeping by the farmer himself, is doomed to failure before it starts, except in a few isolated cases. And in these cases it will generally be found that the man who keeps the books is a better bookkeeper than he is farmer. If he succeeds at farming it is because he has a first-class farmer working for him.

The mental equipment and training of a first-class farmer are radically different from the attributes that are called for in a first-class bookkeeper and accountant. But that is not the sum total of the difficulties in the way of the general introduction of accounting on farms. The truth is that the trained accountant, the man who has spent his life meeting the wide variety of accounting problems presented by modern industrial organization, will fall down completely in the face of the special problems presented on a farm. It has happened again and again. The reason is that the transactions on a farm compare in complexity with those of very large industries which have a high proportion of interdepartmental business, and to this is added a continual shift of labor and equipment from one department to another. When to this is added the fact that it is impracticable to weigh, measure and record all the supplies used, the problem appears in its true proportions. An accountant will suggest methods by which all these matters may be controlled and recorded, but it will be found that the cost of keeping the records will exceed their value because of the relatively small total business of the farm.

The five years of study which my organization has devoted to this problem, at close range, shows that it resolves itself into three parts: First, to assemble the really valuable data of farm operation in a form that would be of practical value to the farmer; second, to reduce the records on the farm to the utmost of simplicity; finally, to obtain really valuable results at such a low cost that every farmer can afford it.

Starting with the unescapable premise that a farmer cannot keep books or, if he does, can rarely analyze them in a manner that will develop really valuable information about his farm, the first principle that we established in our work was to take all the bookkeeping off the farm.

How Can It Be Done?

The farmer is regarded as the manager of a plant would be regarded in a manufacturing operation. He is supplied with a simple set of forms upon which the daily transactions in cash, labor and supplies are recorded. The forms which he uses are bound in such a way that he keeps a copy of all his records, mailing the original to a bookkeeper.

The question arises then, as to who is to be the bookkeeper? In our work to date, we have dealt principally with business men who own farms, because they quite naturally have been leaders in the movement for better farm accounting, and it frequently happens that they have in their offices a bookkeeper who can be instructed in the proper method of keeping farm books. But frequently, even when such bookkeepers are available, the owners prefer to have their accounts kept in our own office, because unless a bookkeeper is familiar with farm practice some very absurd mistakes are made.

The best combination is a man familiar with bookkeeping who also understands farm practice, so that he may properly interpret the records made by the farmer, even if the latter are not as complete as would be desirable. Even when the posting is done by a bookkeeper we frequently send our own farm accountant out at the end of the year, to close the books and draw off analyses.

In picturing the future development of farm accounting we can see several lines along which it can progress.

The first line would be through country banks. No set of men are more interested in improving the farming practice of their community than country bankers. They all employ bookkeepers who are familiar with farm practice. They can afford to encourage their farmer customers to have their books kept at the bank and can offer them a direct benefit as they can more safely make loans to such farmers.

Another line along which this work can develop is through individual bookkeepers in country towns, making a study of it and keeping the books for a group of farmers.

Then there are the Federal Farm Loan Associations, which have an interest and a right to be posted on the transactions of their borrowing members, and there are other farmer associations that might take the subject up.

As one good bookkeeper can keep the accounts of about ten farms, the cost to each farmer need not be excessive, though farmers who have not kept any records will undoubtedly be surprised at the amount they can really afford to pay to get good records and analyses upon which to base their future plans.

Reconstructing Ocean Highways After the War

How To Make Our Shipping Go Around, and Have Ships When and Where We Want Them

By L. W. Schmidt

THE sea-borne trade of the world was carried, before the war, by multitudinous ships of different speed, character and carrying capacity. Shipping rates were not computed on a basis of distance alone, but were also influenced by operation costs, speed, tonnage supply and demand, period of the year, character of merchandise and many other factors of more or less importance, too numerous to mention. The result was that rates varied widely, so that the consignor of merchandise, especially if of large bulk and requiring a considerable tonnage for its transport, was rarely able to estimate in advance his shipping expense. Many of the influences thus determining ocean freight rates are characteristics inherent in the operation of ships. Others can be avoided as resulting from long-standing habit in what must be called bad management and bad engineering of ocean traffic.

Conditions have already changed somewhat since governmental control has become supreme. Water transportation rates are still high, and there is a scarcity of shipping easily explainable on the ground of the enormous demands resulting from the war, but there has been an absence of rate fluctuation which would only a few years ago have been thought impossible. Governmental control has stabilized rates, even if by the power of might, and it has at least provided shipping for the most urgent needs of the nation; but it has not been a cure for all ills. One of the principal causes of freight fluctuations in pre-war times still remains—the prevalence of empty shipping on the leading water routes of the world.

There is no more difficult problem in the economics of transportation than that of providing carriers for all wants without wasting tonnage in the attempt to concentrate it at the points where it is required. On our railroads we have vast stretches of track given over to trains of "returning empties," because loads can be found for them in one direction only. On the rapid transit systems of our great cities we have the tracks leading out of the business center cluttered up during the morning rush-hour with trains bearing only the operating crews, while in the evening the reverse is the case. Even when we come to install motor-truck routes over the highways, we find the limiting factor to be the extent to which return loads can be provided. And just so it is with ships. The empty ship costs money for its operation, and this money must come from the ultimate consumer of tonnage. The most dangerous enemy, before the war, of cheap and permanent rates was the existence of a great bulk of unused tonnage floating from port to port in search of employment.

After peace has become effective, and when governmental control is withdrawn, a return to pre-war conditions may be anticipated. But there must be no return to conditions under which shoals of empty hulls raced around the seven seas in an endless search for paying freights. There should be an end to a system whereby merchandise rots in one port while shipping men are clamoring for freights in another.

The men of the old school will hold that whatever may be the conditions in ocean traffic after the war, freight will have to be carried from the points where it is found to the points to which it is consigned. This is true enough; but it is equally true that shipping has not paid as it might have, and that shipping men have always taken exceptional risks as compared with those laid upon men engaged in the general course of enterprise. If every ship sailing the ocean could be operated with a full cargo for every voyage there would be no complaint that ships do not pay. Transportation, of course, is different from ordinary business enterprise. A certain surplus of facilities must be kept in reserve, against a time of unusual pressure. But the bald fact is that unless a use can be found for this surplus, we cannot afford to maintain it.

The world produces an enormous quantity of transportable merchandise, and the producers are always willing to send their goods from point of production to markets of consumption, provided they can do so at a rate low enough to make a profit on its sale. It has paid shippers frequently to take building bricks from Antwerp to Buenos Aires, though they are made very cheaply in South America; and many other so-called non-paying freights are carried when others are not obtainable. Cannot this be made a general rule to be followed by tramps and slow steamers in order to avoid the disadvantage of having to send empty tonnage from one port to another? Again, would it not be possible so to organize the distribution of merchandise to points of shipment as to eliminate the danger of sudden accumulation? Such a condition, when once set up, is difficult to overcome, and invariably leads to loss to the owner of the goods, who pays a higher price for transportation and receives less for his goods in consequence of the oversupply.

International control of the world's shipping has been proposed, is an eminently sensible measure, and enjoys much likelihood of eventual adoption. But to make useful the existing shipping at lowest price under a system of international control the first essential is a corresponding control over distribution of the world's merchandise. It would be necessary to prevent the producer of rubber in the East Indies from sending his product to London instead of to America where it is consigned. Europe should live from the hides produced in Russia and Asia, leaving to America those from Argentine and her neighbors. The products of Europe again should find their principal markets in parts of the world favorably situated for their distribution.

It is clear that inflexible and universal application of the principle thus brought out is not feasible. But some sort of control, both of shipping and of raw materials will be required for a while after the war. After the period of rehabilitation is gone, however, a return to normal conditions is looked for, with free competition of commerce and shipping. It is with this period that we must be mostly concerned. When it is reached, whatever form of governmental control over production and distribution is undertaken, it must not be of an arbitrary character. To be a useful adjunct to international trade and commerce its aim must be the removal of the causes that have led to pre-war conditions in international traffic, not a mere regulation of ocean lanes and terminals.

There is a vast fundamental difference between railroad and shipping transportation. The railroads are tied down to the rails on which they run, but their terminals are in the hands of their builders, and may be erected wherever necessity arises. Ships, on the other hand, have at their disposal the unrestrained paths of the sea, while their terminals are predestined. While railroad distribution can therefore be made to a certain extent independent of geographic limitations, shipping must always depend upon its ports; whatever route it

(Continued on page 445)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Self-Loading Rifle

To the Editor of the SCIENTIFIC AMERICAN:

In his interesting article on the self-loading military rifle which appears in your issue of October 5th, Mr. Crossman, in describing the action of recoil-operated arms, speaks of the retractor spring as having an appreciable effect in resisting the backward thrust of the cartridge in the chamber. This statement attributes to the retraction spring a function in which on analysis it appears to play a negligible part.

The retractor springs in self-loading pistols of the Browning type are light enough to permit the bolt being drawn back by hand, while the pressure of the cartridge is measured in thousands of pounds, even in such a small arm as one of 32 calibre obviously a 10- or 15-pound spring has little effect in resisting the cartridge thrust, and its only real function is to store enough of the energy of the recoiling parts to raise the hammer, insert a fresh cartridge and to return and hold the bolt against the cartridge.

This point was demonstrated several years ago in a rough test of the action of an early model of a 32-calibre Colt automatic pistol. The arm was of the "blowback" type with the barrel locked to the frame and a free breech-block. The retractor spring was removed and the pistol was fired in that condition. The breech-block flew back and ejected the empty shell as under normal conditions, and nothing unusual happened except that the breech remained open. The empty shell showed no sign of bulging or the possible tearing apart referred to by being "glued" to the barrel under the high pressure.

The tearing apart of the shell would naturally occur if the total surface of the shell in contact with the chamber were exposed to the gas pressure within and not balanced by pressure without. In the blowback pistol, the shell undoubtedly does slide out of the chamber a short distance (by computation, a little over $\frac{1}{16}$ of an inch in the 32-Colt), during the interval of time taken for the bullet to travel the length of the barrel, and the shell is not injured thereby.

The action of the ordinary hydraulic cup-leather, which operates as a fluid pressure check in a manner similar to the shell, disclosed by a consideration of the wear which takes place, may afford an adequate explanation. Nearly all the wear in a cup-leather takes place on a narrow surface of the lip adjacent to the rounded portion. The pressure on the inside of the lip is, therefore, balanced by pressure on the outside, except at the narrow surface of wear and contact. On such a surface, which is quite narrow, the total pressure and resulting friction are relatively small.

LUCIEN E. PICOLET.

Washington, D. C.

Engine Power and Weight

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 5th ("Evolution of the Aircraft Engine," page 270), I note that you quote the Langley-Manley motor of 1901 as 2.9 pounds per horsepower, and couple with the quotation the statement that, "It was nine years ahead of its time in the matter of power output, and 16 years ahead in its weight per horse-power."

It seems to me that this statement is misleading, since the power used was steam, and therefore limited in its enduring capacity to a few minutes. A motive power of this kind should be properly classed with that of rockets or similar projectiles, which depend for their energy upon the rapid generation of highly heated gases which produce tremendous power *for a short space of time.*

The immense weight of water and fuel required for a steam engine having anything like the flight period of the modern aeroplane would be so great as to render the machine practically inoperative.

The above does not in the slightest degree detract from the brilliant conceptions and achievements of Professor Langley. Had he been possessed of the motive power of the present day, he could undoubtedly have designed a machine of man-carrying capacity with a sufficient flight period to have demonstrated practically the high utility of this form of mechanism.

ELWOOD HAYNES.

Kokomo, Ind.

How Much Further?

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 5th, I notice a letter from Mr. John about the origin of the toothless saw.

I will say that I remember going, when a small boy (I was born in 1846), with my father to the Norwich Foundry and Machine Shop, at Norwich, N. Y. When he got his business done he was invited to go upstairs and see their "sheet iron buzzer." He went and I followed.

Three or four head men of the company were at a saw table. They had a circular piece of sheet iron about five or six inches in diameter, mounted on a shaft at the table. They were demonstrating it on cast iron bands about 2 by ½ inches. I recall vividly how the "buzzer" hummed when it was started.

The bands were cut by this buzzer in the way already described in your columns, with an accompaniment of a stream of fire about two feet long, which seemed to me the most wonderful thing I had ever seen, so much so that I have always remembered it, and always will.

I should place this in the early fifties—perhaps in 1853. I would suggest that this toothless saw was developed quite independently at different times and in different places. It seems out of the question to suppose that, from any single origin, it could have spread over so large an area without coming into greater popularity.

C. W. POWERS.

Preston, N. Y.

Quantitative Spectrum Analysis

To the Editor of the SCIENTIFIC AMERICAN:

I notice an article in your October 19th issue, under the above caption. Some years ago I was interested with the late T. F. Witherbee, of Port Henry, in the analysis of open-hearth steel. We were confronted with the fact that the time taken to determine the essential contents of the steel was such that it showed what had been, but not what was; for no matter how careful the furnace man was, the contents of furnace was always changing. This led us to the idea of burning the sample in an electric arc, and determining the carbon, etc., by the spectrum; but owing to our lack of facilities we were unable to carry out our idea. I still believe that this could be carried out to great advantage in steel making, where time is a prime factor.

W. VIGGERS.

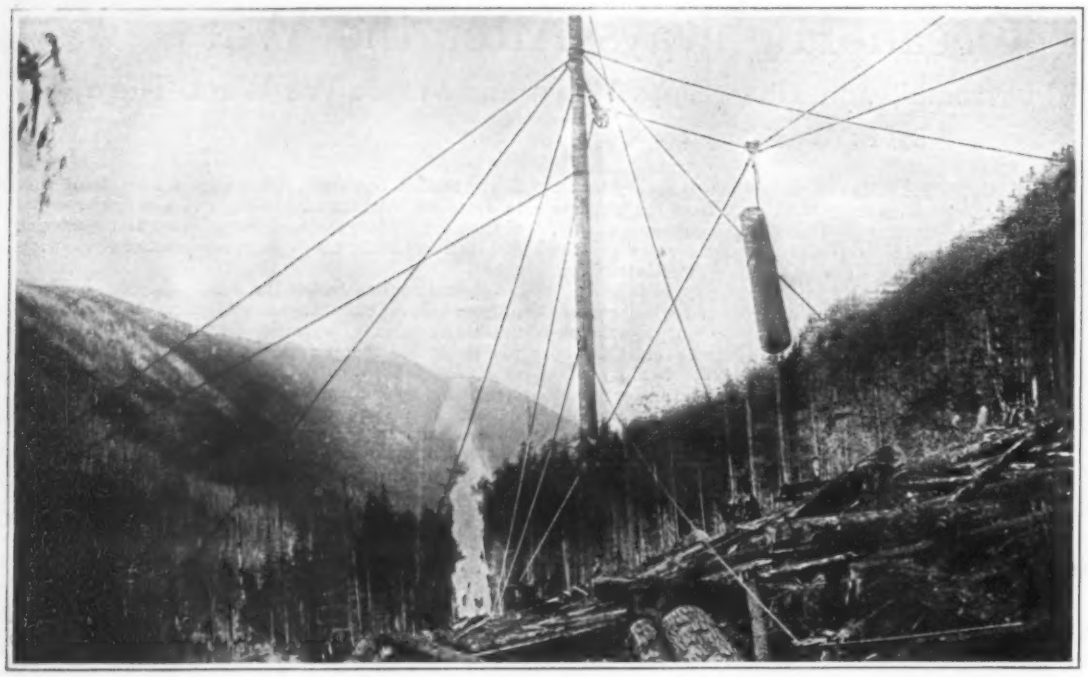
Durango, Mex.

Organization of a National Salvage System

MR. B. M. BARUCH, chairman of the War Industries Board, in a recent circular states that the Government has long felt the need of a national salvage system, and recently the situation has become more critical, especially with regard to the paper and pulp industry. To the end of securing an adequate method of collection, the War Prison Labor and National Waste Reclamation Section of the War Industries Board has been organized and a working plan for every organized community, including towns with 5,000 population and the outlying districts to the large metropolis centers, has been formulated which covers a wide scope and takes care of the organization, collection, disposal, and the prices to be received on all waste materials.

The most important materials desired to reclaim at the present time are paper, cotton and woolen rags, steel, copper, brass, zinc, rubber, tin, leather, lead and tin foil.

With the organization of the local councils, through the War Prison Labor and National Waste Reclamation Section, collection and disposal methods will be arranged for everyone—the households, apartments, department stores, office buildings, city, State, and Federal buildings.



The "high line" of steel cables strung from tree to tree, with ground cables to give rigidity

Donkey engines loading logs direct

Getting Out Airplane Spruce

The Engineering Aspects of This Feature of Our Program

By Fred W. Vincent

WHEN America entered the war, and the urgent call for airplane spruce was made, it found the nation worse than unprepared. For two years, Great Britain, France and Italy had been buying every available stick of this most precious of flying woods. Practically all accessible spruce along the water courses and logging roads had been cut in the Pacific Northwest—the only place in America where this variety of timber grows in marketable quantities. But America has been able to supply herself and her allies with almost one million feet of airplane spruce daily. When it is remembered that approximately 85 per cent of the tree must be wasted to secure the perfect lumber so vital to our airplane program, the splendid accomplishments of the last few months can be dimly appreciated.

The results now being attained are due almost wholly to the unparalled feats of engineering performed by the civilian-soldiers known as the Spruce Production Division of the Signal Corps of the United States Army. These men, drawn from all ranks of life faced, not only the vital element of time, but likewise, natural conditions by far more severe than any found along the battle front of France or Flanders. Heavily timbered mountains that range in height 1,000 to 5,000 feet—impenetrable underbrush—deep canyons—swift roaring mountain torrents—clay and soapstone soils and the heaviest rainfall in America to make the region a running sea of mud in winter time, are a few of the obstacles that stood in their way. Added to this, the men to whom was entrusted the stupendous task of "Getting out the Spruce," found the country practically unsurveyed and tapped only slightly here and there by logging roads. Much of its wild topography had never been trod by man.

But the nation had to have the spruce. Without it, the $685,000,000 airplane program would have been absolutely worthless. Spruce, due to its lightness, great strength and long fiber, is the king of wood for aircraft. It was with full realization of this fact that the Spruce Production Division was organized in November, 1917, and undertook its huge task.

While surveyors and timber cruisers were engaged in reconnaisance, Colonel (now Brigadier General) Brice P. Disque, from his headquarters in Portland, Ore., called upon timber workers to hand-rive the spruce. This method necessitated spruce production almost wholly by manual labor. It maintained production, however, at better than two million feet per month. Experience, by this time, had shown that the lumber mills were unable to saw the rived cants without terrific waste of the precious material due to the fact that the wood must be sawed to grain and the grain is slightly spiral.

This brought the division face to face with three great problems. First, economical sawing operations—second, adequate transportation—and lastly, maximum spruce production. It took just 45 days to build, at Vancouver, Wash., the largest spruce cut-up mill in the world.

Meanwhile maps had been made, the greatest stands of spruce located, and locations for logging roads to tap them tentatively selected. In addition, logging roads already laid to spruce stands had been extended. As an indication of the rapidity with which the movement got under way, a report of the first four months of work shows that the government had obtained for loggers more than $1,500,000 worth of donkey engines, $750,000 worth of steel rails and had, through the cut-up mill's operations, affected a saving of 75 per cent in the number of freight cars necessary to ship lumber east, amounting to about 3,000 cars a year.

Spruce production, in the meantime, had jumped to 5,000,000 feet per month. The Spruce Production Division had increased from a few officers to more than 5,000 soldiers, and in addition, 80,000 of the civilian timber workers in the Northwest had been organized under the name of the Loyal

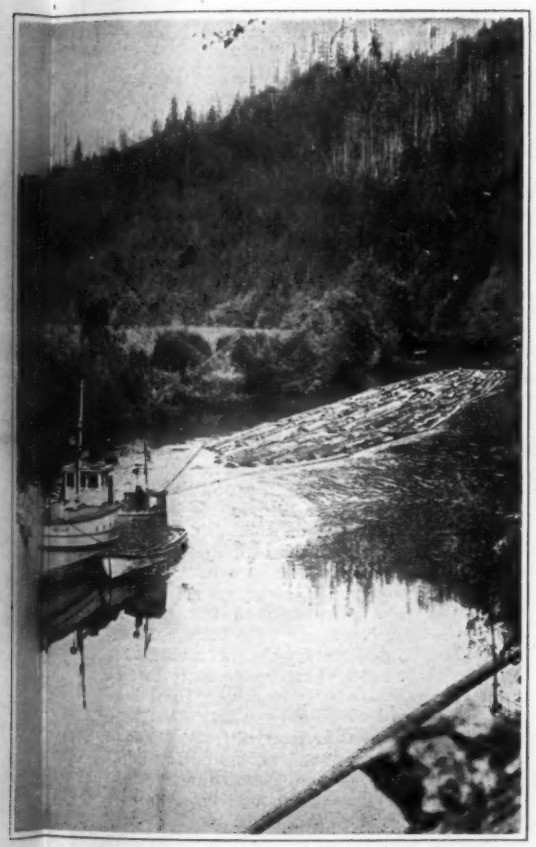
A donkey engine hauling itself across a ravine on skids and log rails laid for the purpose

The fellers have done their work; the dogger, chasers and riggers now step in

The logs are split by hand, with wedges, power being

ing logs direct from "high line" to the cars

The terminal of the logging railroad, where the logs are slid into the water and made into rafts



A fresh-water tow of a log raft to convey the spruce from the terminal of the logging road to the mills at tide water

Legion of Loggers and Lumbermen—men pledged to uphold the government and to "Get out the Spruce."

Armed with the cruisers' reports and their own surveys, the engineers began actual logging railroad construction last spring. The fruits of their labor are being harvested now. Thirteen roads, each from three to 72 miles long, have been built into the timber. They comprise a total of 173 miles of main line, 181 miles of spurs; and 1,500,000,000 feet of spruce has been opened up. Some of these lines are standard main line construction because of their salvage value after the spruce is cut. Others are only temporary. All are designed to carry heavy logging traffic during the rainy season which now is on.

This necessitated many types of construction. Due to the clay soils, all the track is heavily ballasted. Where large excavations or embankment work was necessary, beach sand, in some place a foot thick, was laid on all fills before ballasting. Cuts are ditched 18 inches deep to assist in keeping the roadbed dry. Although the Coast Range, the Olympics and the Cascades are among the roughest mountainous regions in America, the railroad grades have been kept under two per cent, for the most part, and on the main lines with very few exceptions, the curvature has been kept under six degrees.

Much stringer and pile work has been done. Several of the lines were built entirely of logs 36 to 60 inches in diameter, placed on cross logs by donkey engines and ties notched into them. Many bridges have been built—some 80 to 90 feet high, mostly of combination pile and framed trestle. On steep slopes where slides were liable to occur, heavy cribbing was placed.

Delivery of material for these bridges was one of the most difficult problems faced. Finally it was solved by making rafts of the material, towing them to sea, and, when the tide was setting in, releasing them from the tugs and trusting to the life-saving station guards to land them safely.

Thousands of caps, stringers, ties and construction timber was handled in this way. In addition, much of it was hauled by motor trucks along beaches and then through forests on planked roads built especially for the purpose. This rapid construction was made possible only by the splendid coöperation of soldiers and civilians who have kept only one thought always foremost—"We must produce the spruce."

Under the direction of Major W. A. Welsh, who, in private life has charge of the Palisades Park Construction along the Hudson River, 11,000 soldiers built the spruce logging roads this year. And now, despite the torrential rains, the spruce is being transported to the mills.

The Vancouver cut-up plant is designed to produce the finished airplane stock. For this reason the logs are first sawn into square cants at tide-water and mountain mills. The work is done by civilians and soldiers, working side by side. From these mills the cants are loaded aboard the commercial railroads and rushed to the cut-up plant where the lumber is sawed into proper dimensions for the airplane factories. Here all lumber except the perfect stock is cast out to save car space. The mill is run 24 hours a day. It has 10 headsaws and 4,000 soldiers comprise its force.

Logging operations call for great skill and great amount of equipment. Outside the actual felling of the trees, many of which are 10 feet in diameter, and more than 200 feet high, most of the operations are carried through by steam power. This entails much expense on straight logging operations. But for spruce the cost is even greater because this tree, unlike Douglas fir or other western woods, does not grow in solid stands. The best spruce stands do not average more than 20 trees to a hundred and a large percentage of these are unavailable because they are knotty or twisted.

In many operations the logs are snaked to the logging road by donkey engine-drawn cables. On steep hillsides these powerful engines mounted on skids drag themselves to the timber under their own power.

High line operations likewise are followed with splendid success, particularly in the heaviest timbered and roughest regions. The logs are carried by steel cables through the air bodily, sometimes for half a mile. Power is provided by donkey engines and the cables are swung on huge blocks lashed to the tops of "spar trees" which are anchored by other steel lines so they can withstand the terrific strain.

Thousands of troops are engaged in actual logging work. They labor by the side of civilians at the same rate of pay and take great satisfaction in the fact that they have made good at their task. They are getting out the spruce—and are doing it so well that Thomas Ryan, head of the aircraft production board, was able to plan, shortly before the German collapse, that at least a regiment of them be spared from their present labors and allowed the high privilege of taking their place on the actual battle line in France.

, power being ruled out because it would injure the fiber

Plank roads that make otherwise impassable routes a practicable means of "getting out the spruce"

The Heavens in December, 1918

Lights and Shadows, Astronomic and Aeronautic

By Professor Henry Norris Russell, Ph.D.

THERE are often relations, which one would hardly expect at first consideration, between phenomena observed under very different circumstances. A curious instance of this sort which has just come under the writer's observation is connected on one side with the work of the astronomer and on the other with the experiences of the aviator; and it may be appropriate to speak of it here.

As an airplane rises from the ground its shadow is at first just what anyone would expect, reproducing closely the shape of wings, fuselage and tail; and all that the novice is likely to notice is the impressive manner in which it seems to recede and shrink as the "ship" rises to those higher levels which seem so far aloft to the inexperienced passenger, and so comfortably safe to the well-informed pilot. But when the observer (supposing that his duties leave him free to look about for the first few minutes of the climb) watches his receding shadow more closely, he is likely to see some queer things. By the time he has reached an altitude of 1,500 or 2,000 feet the shadow is no longer sharp, but very diffuse; and at a somewhat greater height—depending on the altitude of the sun at the time—practically all trace of the outline of the plane is lost, and the shadow is *round*, and no longer dark, but a faint patch. At still higher altitudes even this is lost altogether to the view of the occupants of the "ship."

Meanwhile, if the shadow falls on country of certain types, such as a grass-field or stubble-field, or upon the leafless woods of late autumn, a strange thing appears. A smallish bright spot, fading gradually on its outer edge, surrounds the shadow and moves with it. This shadow is sometimes called a halo; but it is evidently very different from the ordinary halos that appear in the sky, for it takes the color of the surface on which it is projected, and looks exactly as though the sunlight, which illuminates the whole surface of the land, was stronger close to the shadow than elsewhere, and hence brought out the natural colors of the surface more strongly there.

This curious phenomenon has been noticed by many observant aviators, but probably few of them are familiar with its cause; and still fewer know that it is by no means a new discovery, but has its place, first in the records of the history of art, and later in the history of astronomy.

Sunlight and Shade

First for the explanation. The halo is not seen on all kinds of ground, but only on surfaces covered with standing vegetation, where the sunlight is reflected, not from a uniform and nearly flat surface, but from a multitude of objects—blades of grass, leaves and branches of trees, etc., which are disposed in space, some in front of others. Under these circumstances—in the woods for example, but little of the direct light of the sun reaches the surface of the earth, most of it being reflected by the leaves. Of the leaves themselves, only those at the tops of the trees get the full benefit of the sunlight. Those lower down get sunlight only in patches, where it comes through the interstices of the foliage higher up; and the deeper one penetrates, the more intensive become the shadows.

Now, if we look, from far above, upon the upper surface of the woods, we will see down through the interstices of the upper leaves into the shadows below. Were we very close, these gaps would appear dark, between the brighter sunlit leaves. From thousands of feet altitude all these finer details are lost, and the mosaic of light and shadows blends into an apparently uniform tone; but this tone is not nearly so bright as it would be if the shadowed gaps were not there.

When we look right down along the paths of the sunbeams which have grazed our own aircraft, however, we would find, if we had a telescope of sufficient power, that we could look down the tracks of all the beams that penetrated the gaps between the upper leaves and see, at the bottom of each track, the bright patch where this sunbeam fell upon something deeper in the woods. These gaps would, therefore, look almost as bright as the rest, and the whole tone of the surface, when blended into a uniform effect by distance, would be much more luminous than in the previous case, where we were looking at a considerable angle to the sun's rays.

Even if our line of sight were inclined but a couple of degrees to the path of the sun's rays, we would miss the bright patches at the bottom of those gaps through which the sunbeams penetrated most deeply, so that the surface would appear considerably darker than it would right at the edge of our own shadow. Hence the luminous patch near the shadow appears of small dimensions; and it is easy to see that it will not be sharply bounded but will fade out gradually.

All that has been said will obviously apply equally well to the separate blades of dried grass in an autumn field; and it is not necessary to go up in an airplane to see this halo. All that one need do is stand, when the sun is low in the sky, and watch one's shadow as one walks past such a field, in which the grass is still standing. If one keeps one's eyes fixed on the shadow, disregarding the details of the grass as it moves past them, the halo is not hard to see; and this time, as it surrounds the head of the observer's silhouette, it may fairly be called a halo, in the artistic if not in the meteorological sense of the word.

If several observers look for this effect, each will see the halo around the shadow of his own head, and not about those of the others; for it is evident that the center of the halo must appear to each man to be exactly opposite the center of his own sun, and his own shadow infallibly occupies that place!

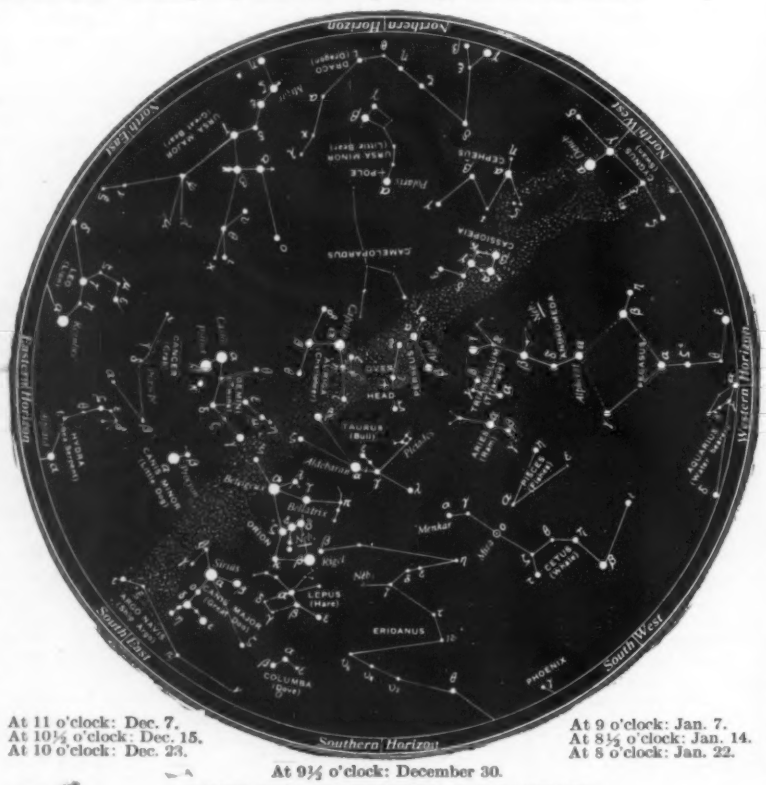
Cellini's Halo

"Thereby hangs a tale." The discoverer of this easily seen but little known phenomenon was Benevenuto Cellini, the great artist. Being one day taken to task by a friend for one of his numerous escapades, he replied that he was something of a saint, and claimed that the halo about his head, though not directly visible, appeared about its shadow, and not around the shadow of other men's heads. They were walking in the fields as they talked, and the artist pointed to his shadow for proof. The friend turned, saw no halo around Benevenuto's shadow, but discovered one about his own; but as the great artist was likewise a noteworthy swordsman, his companion deemed it prudent to refrain from making any claims of superiority, and so the matter rested. But later the story became known, and the bright spot about the shadow still bears the name of "the halo of Benevenuto Cellini in memory of its illustrious discoverer."

But what has all this to do with astronomy? Simply this: that the rings of Saturn show an exactly similar increase of apparent brightness as the planet approaches the region of the heavens which is exactly opposite our sun; which makes it clear that, if we could put a whole army of Saturns in array in the sky, so that apparently they formed a continuous screen on which the sunlight fell, this screen would grow brighter toward the point opposite our sun, and, indeed, would show Benevenuto Cellini's halo.

It follows that the rings, like other objects which show this effect, cannot present a smooth surface, but must be composed of separate particles so distributed that we see between those near the front surface, down into the deeper regions. This proof of the meteoric constitution of the rings, which is only one of several lines of evidence for the fact, has been developed in great detail by Seeliger, and is further confirmed by recent observations of Guthnick, who finds that the increase in brightness of the rings close to the point of opposition is very marked, indicating that we are able to see down between the patches to a depth which is many times their average diameter.

So much for the halo about the shadow of the airplane. But why should the shadow itself appear round? This is an easier question. When the plane is so high that, as seen from the ground, it looks considerably smaller than the sun, the best that it can do in the way of casting a shadow is to cut off part of the sunlight; hence its shadow appears but little darker than the surroundings. The shape of the region from which, at any moment, it thus obscures part of the sunlight, will in this case depend mainly, not upon the shape of the airplane, but upon that of the sun; hence the shadow is practically round. There should be no difficulty in seeing the same thing in the shadow of any small object, suspended in the air by a thread, and cast upon a screen at such a distance that the object obscures but a part of the sun's disk.



At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9¼ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

The Heavens

Our map shows the appearance of the winter heavens better than any mere verbal description. Orion is high in the South, with Canis Major below on the left and Taurus above on the right. Gemini is above Orion on the left. The very brilliant object that appears in the sky but not on the map is the planet Jupiter, resplendent this month in all his glory.

Canis Minor is below Gemini, and then comes Hydra, to the left, with Leo next. Saturn, which is in this constellation, is now so near its brightest star, Regulus, that they appear to the eye almost as a double star.

The Great Bear is well up in the Northeast, and the Little Bear and the Dragon are below the pole. Cassiopeia and Perseus are high in the northwest, and Auriga is overhead. Pegasus is setting in the West, while Cetus and Eridanus fill the dull Southwestern sky.

The Planets

Mercury is an evening star at the beginning of the month, but soon draws in so near the sun as to be unobservable. After passing through inferior conjunction he comes out as a morning star, and can be seen in the dawn at the end of the month.

Venus is just past superior conjunction and, though theoretically an evening star, is practically invisible. Mars is an evening star in Capricornus, setting at about 7 P. M. Jupiter is in Gemini, approaching opposition, and conspicuous almost all night.

Saturn is in Leo, very close to Regulus at the beginning of the month, and rising about 10 P. M. Uranus is in Capricornus, and sets about 9 P. M. in the middle of the month. Neptune is in Cancer, observable after midnight.

The Moon is new at 10 A. M. on the 3d, in her first quarter at 9 P. M. on the 10th, full at 2 P. M. on the 17th, and in her last quarter at 2 A. M. on the 25th. She is nearest the Earth on the 14th, and farthest away on the 27th. She is in conjunction with Venus on the 3d, Mercury on the 5th, Mars on the 6th, Uranus on the 9th, Jupiter on the 18th, Neptune on the 20th, Saturn on the 22d, and Mercury again on the 31st.

At the time of new moon there is an annular eclipse of the sun, the path of the annular phase crossing the South Atlantic, passing over South America from Buenos Aires to Santiago, and extending far into the Pacific. The maximum duration of the annular phase is about seven minutes. The eclipse is visible as a partial one throughout western Africa and all South America below the equator.

At 11 A. M. on December 22d, the sun reaches its greatest southern declination, and, in almanac phrase, "winter begins."

Langley Field, Hampton, Va.,
Nov. 17th, 1918.

A Use for Pine Needles

IT has recently been discovered that the leaves of the pine make a very fair substitute for bristles in the making of brushes and brooms. These are to be found in huge quantities on the ground in fir forests and, owing to the large amount of silica in them, they are hard and do not decay rapidly. They are of varying length according to the kind of tree from which they fall. In some cases the leaves are six or even more inches long. The pine needles are dealt with in two ways. Where they are long they are simply bunched together and firmly tied with some material, then a stick by way of a handle is pushed down the center. In this way serviceable brooms are rapidly made. The other plan is to insert clusters of the smaller needles, in holes, in a thickish piece of wood. These holes are filled with hot pitch and, when this material has set hard and dry, the pine leaves are held firmly in place. Usually they are all of the same length, but it is easy to trim the brush after it has been made.

Some elaborate tests have shown that the pine needles wear very well indeed. They are not more easily broken than much of the material which has been commonly used in broom making and, owing to their hardness, they can withstand a great deal of friction. It goes without saying that vast quantities of pine needles can be collected for nothing wherever the trees abound.

The American Pacific Ocean

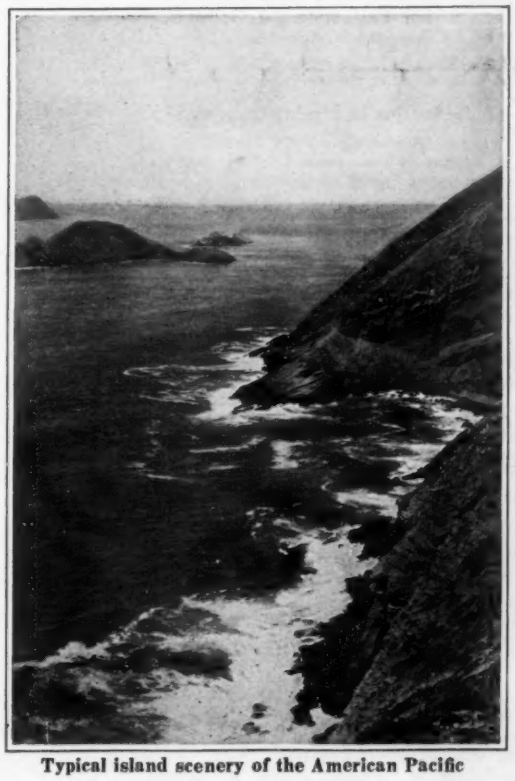
Results of a Comprehensive Survey Undertaken by the University of California

IT has been, perhaps sufficiently impressed upon us that the much advertised influence of the Gulf Stream upon the climate of northern Europe is a delusion and a snare, that in the neighborhood of Britain and Scandinavia there can not be found enough of the Gulf Stream to change the temperature of a bath, let alone of half a continent. It now appears that the Japanese current, to which the alluring climate of our Pacific coast has so long been attributed, must, so far as its influence upon America is concerned, submit to the same fate as that which has overtaken its older relative. It stays at home on its own side of the Pacific, and in no way imitates Asiatic peoples in their invasion of America. Such, at least, is the verdict announced by the scientists of the Scripps Institution of the University of California, who have completed a six years' examination of the American portions of our largest ocean. Nor is this the only contribution that has been made to our oceanographic knowledge as a result of this undertaking. Biological and hydrographic surveys on a comprehensive scale have been completed, and the whole eastern floor of the Pacific has been mapped, checking up with the operations of the United States Coast and Geodetic Survey.

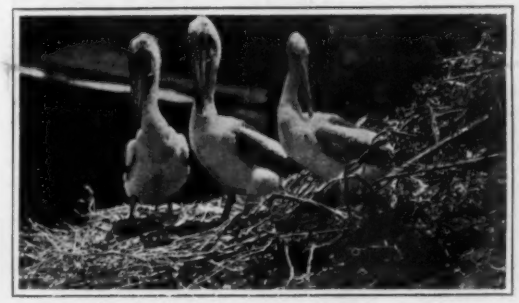
Another interesting conclusion drawn by the Scripps investigators is that in reference to the Pacific islands. Heretofore these have been considered to be uplifts, due to natural convulsions. The inference drawn from the Scripps survey is that the ocean floor is merely a continuance of the Pacific regions of the American continent, which owes its present low level to a subsidence probably occurring within the past million years. The existing islands and peaks, on this viewpoint, are then merely elevations too high to be covered by the inflowing water. It is to be borne in mind, however, that while subsidence may thus account for the existing islands of the Pacific, we know that the marine volcanoes are caused by diastrophic elevations. New volcanoes are being constantly thrust above the water in the North Pacific by the Alaskan convulsions—in fact, we have here a continuous performance. These convulsions are evidently due to the increasing weight of the Polar ice cap, caused by a succession of increasingly severe winters. Dr. Robert S. Griggs, of the National Geographic Society, has been studying these phenomena for some years.

Perhaps the major share of the attention of the Scripps survey has been given to problems of ocean fauna. Dr. George E. McEwen, hydrographer of the Institution, asked and after five years' work answers the question, "In what sort of waters do the sea creatures dwell which swarm in such infinite variety off the coasts of California?" This is a significant query, for a satisfactory census of the sea must include not alone knowledge of its inhabitants, but of the conditions under which they live. Dr. McEwen has made thousands of soundings and hauls, studying variations in the sea as regards temperature, light, salinity, gas content, movement of currents, etc. Knowledge of all these factors is necessary for a true understanding of the behavior and distribution of the ocean fauna.

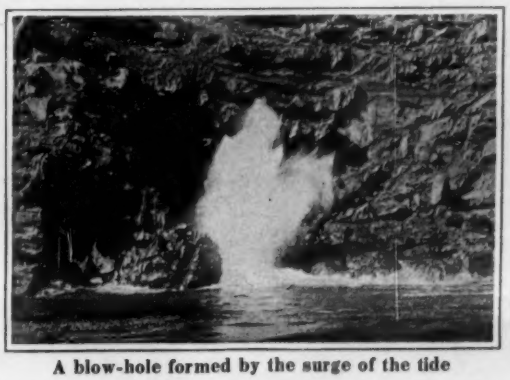
Yaqui fishermen getting fresh seal meat—a dead yearling, and a very live pup who is putting up a sturdy fight



Typical island scenery of the American Pacific



Infant members of a pelican family on Santa Barbara where they have few natural enemies



A blow-hole formed by the surge of the tide

Great valleys, deep beneath the ocean, are revealed by the soundings close to the California coast. A few miles west of Catalina, for instance, is a submarine valley into which a mountain a mile high could be dropped and still ships could sail safely over its summit. The mountain-tops of Catalina are as high above its ocean-floor as the Sierra peaks above the Owens river valley. These submarine depths are very different from surface waters. Two hundred feet down, there is scarcely one per cent as much light as there is 3 feet below the surface. Thirteen or fourteen hundred feet below the surface the temperature, summer or winter, is about 44 degrees Fahrenheit, and stays about the same the year round, while on the surface, a few miles west of the Coronado Islands, for instance, the water varies in mean monthly temperature from a minimum of 57 up to 68 degrees. It has been proved that as a result of the displacement of surface waters by prevailing winds and consequent changes in pressure, the colder waters from the depths of the sea come welling up along the California shores and play a great part in producing the cool summer temperatures which are such a blessing to the coast region.

A striking example of this is that the water just off shore from Point Dume, at the northern end of Santa Monica Bay, is nearly ten degrees colder than that in the open channel over toward Catalina Island or San Clemente. At the same moment the water along the bathing beaches of Santa Monica Bay will be nearly ten degrees warmer than the water close by at Point Dume. The explanation is that from Point Dume, Point Vicente, and Point Fermin submarine cliffs and mountain-sides go plunging down beneath the sea, until within a short distance a depth of more than two thousand feet is attained. From these deep submarine valleys colder waters constantly rise. The same phenomenon prevails from Mendocino County to a point far down the lower California coast.

How greatly sea-water may vary in temperature within a short distance is shown by the fact that with water at the harbor-mouth of San Diego Bay at a temperature of 66 degrees, the shallow waters in the bay off National City registered 80 degrees. A curious fact is that a difference of several degrees has frequently been observed in the temperature of the water in samples taken not sixty feet apart, near the Coronado Islands.

The surface sea-water off the coast of California is coldest in February, and warmest in August, but sea-water is coldest in May at depths below a hundred feet, and below 170 feet warmest in November. The salinity of the surface waters is least in February and greatest in July or August, while at a depth of 230 feet, say, it is least salty in November and most salty in April.

It is worth a sea-bather's while to know that the prevailing daily variation of the waters near the coast is only about two degrees, the water being coldest between one and two A. M. and warmest between five and seven P. M. Below 80 feet there is practically no daily variation in temperature, but shallow waters on sunny days of course vary greatly.

Dr. McEwen finds that the absorption of solar radiation which tends to heat the water is accompanied by the processes of evaporation and convection which tend to cool it. If these opposing influences are not balanced, the temperature must change. For example, if the heat lost because of evaporation and convection is less than that absorbed from solar radiation, the temperature will rise. But as it rises, the rate of loss of heat will increase. If the heat due to the absorption of solar radiation is gained at a constant rate, the temperature will ultimately increase until the heat loss equals that gained. Similarly, the process of evaporation, which increases salinity, is accompanied by the opposing processes of convection and diffusion.

An interesting and unusual feature of the Pacific, brought out by another division of the University, is that many species of birds were marooned on the islands off the California coast, countless ages ago, when the mountain ranges of which these islands are the gravestones sank beneath the ocean, leaving only the protruding peaks now known as the Santa Barbara Islands. These bits of solid ground in a waste of waters are a veritable bird paradise. Natural enemies are few; even the foxes, once numerous on Catalina, are now almost extinct, through contracting scabies from the sheep, resulting in blindness and starvation. The most dangerous foe of the birds are a considerable quantity of the ordinary *felis domestica*, descended from pussies which, from time to time, have escaped from visiting boats or camping parties. Another curious danger which the birds must meet comes from one species of large fish; when the young *Xanthus Murrelet* first tries to swim in the sea, at an age of three or four days, these piscatorial carnivores get a good many of them, despite the aquatic skill of the fledglings.

Many of these islands are wholly without water and hence uninhabited save by the birds. No less than 195 species of the latter are declared to be permanent residents or regular visitors. Aside from those which date back to the time when there was a land bridge connecting with the mainland, there are doubtless a good many species that became colonized through wandering out from the coast in the fog, or being blown out in heavy storms. The stage has been an ideal one for survival of the fittest to display its workings, for species which did not chance to be adapted to the changed conditions of life on the islands could not seek more congenial surroundings, but must get along on the islands or perish.

As might therefore be expected, the island life has actually altered the habits of many of the birds. The song sparrow, for instance, no longer builds a shady retreat in the dense brush of a damp ravine, but frequents the ice-plant and the short grass of the Santa Barbara mesa. The house finch has settled in pockets of the conglomerate cliffs, while the dusky warbler, instead of building on the ground, has grown to prefer a vine, shrub, or even the branches of a tree. The island mocking bird and house finch wear feather bibs deeply stained by the red juice of the opuntia cactus, on which they feast.

The whole life cycle of the smaller birds of these Southern California islands is shifted a month or six weeks earlier than on the mainland. This early nesting is due partly to the mildness of the winters, but even more to the abundance of the food supply, for insects abound everywhere, since there is no frost to reduce their numbers. Moulting is earlier than on the mainland, and birds in fresh plumage may be taken in early August, or even sooner. Despite the house-cats, which roam wild on many of the islands, small birds are particularly numerous, because of the abundant food supply, the infrequency of natural enemies, and the excellent cover afforded by cactus and thorny scrub, where they can nest and rest secure from everything—except, in the

(Continued on page 445)

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Electrically-driven plane for the carpenter

Putting Speed Into Planing

THE application of electricity is now made to the bench plane, the carpenter's tool used on small jobs. Hand work for this class of labor is too expensive and slow. The modern planer is connected to an electric light circuit and by the snapping of a switch is ready to work. It does planing, surfacing, beveling, jointing and fitting more cheaply than they can be done any other way, besides speeding up the work. The machine is simple in construction, no intricate parts to get out of order, and the circular safety cutter head is made in one piece of high grade steel. A motor by direct connection to cutter-head furnishes the energy. There are no injured fingers with the new device for the reason that a flap guard keeps the knives covered. This safety feature slides over automatically as the material goes through the machine.

Electric Bulletins from a Typewriter

NEWS bulletins, flashed in big electric letters almost simultaneously with their receipt over press wires, is made possible by a new electrical device. This invention consists of a huge bulletin board, operated by a typewriter. It is called an electrograph.

On either side of the board, which towers above a newspaper building in a mid-western city, are 60 monograms, arranged in three rows. Each monogram, which measures 2 by 3 feet, contains an arrangement of 21 lights, various combinations of which form any letter or numeral, the dash, question mark and dollar sign.

Selection of the groups of lights to form the various characters is done by pressing the desired keys on the typewriter. Selection of the monograms is done automatically through an extra platen on the typewriter. Thus, when the operator writes a bulletin on the typewriter, the letters appear in quick succession on the board and remain until the bulletin is completed. The bulletin may be left on for any desired length of time and then released by pressing a single key. A unit releasing device enables the operator to strike out a single letter without interfering with the other letters. Thus, when an error is made the correct letter may be inserted without writing the entire bulletin again.

As the keys are struck to produce the letters on the board, the same bulletins are written on paper in the usual way thus giving a complete record of everything flashed.

An interesting feature is the rapidity with which the bulletins may be flashed. An ordinary bulletin may be written in 10 seconds, the operator writing just as he would on any typewriter.

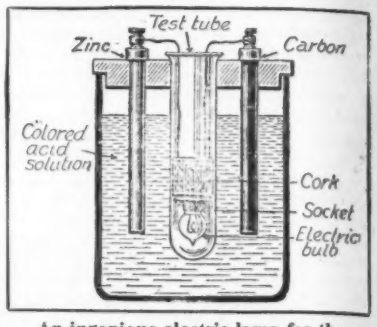
As the operator cannot see the board as he works, a pilot board has been provided directly before him, consisting of 60 green light bulbs. When he strikes a key, the action throws on the corresponding letter, which in turn lights the green bulb corresponding to the number of the monogram in which the letter appears. For instance: if he strikes the "A" key, with the platen set at No. 1 position, the letter "A" will appear on the first monogram of the board and No. 1 green light will burn. If it does not burn, the operator knows that the letter did not appear and he strikes it over.

Advertising bulletins are flashed along with the news bulletins, thus proving the device practical as well as novel.

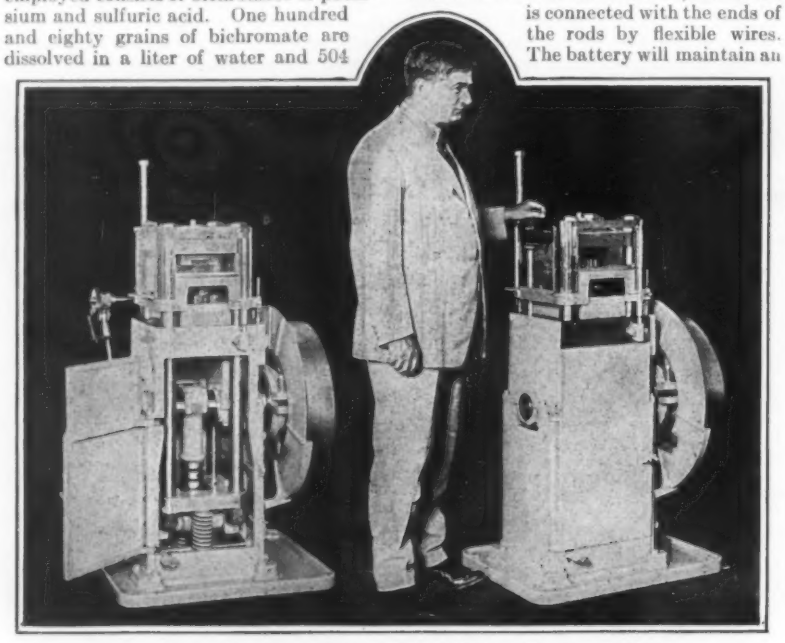
A Novel Lamp for Photographic Laboratories

A DEVICE as simple as it is ingenious for furnishing the necessary red light in a photographer's dark room consists of a small electric light operated by a single cell battery in which the solution employed consists of bichromate of potassium and sulfuric acid. One hundred and eighty grains of bichromate are dissolved in a liter of water and 50½ grains of if sulfuric acid are then slowly added. The liquid thus obtained is placed in an open mouthed transparent glass vessel—one of the jars used for a Lechanche battery, for example—filling it to within two or three inches of the top.

The jar is covered with a plate or stopper pierced by three holes, as shown in the accompanying diagram, for which we are endebted to *La Science et la Vie* (Paris). The two smaller holes hold rods of zinc and graphite respectively, the zinc being preferably amalgamated. The central hole is of such diameter as to support a test tube, which, like the rods of zinc and of carbon, extends into the liquid below. Within the test tube is placed a small electric bulb of two to two and one-half volts which is held in position by a cork into which its socket is fastened, and which is connected with the ends of the rods by flexible wires. The battery will maintain an electromotive for ceof 2½ volts between its electrodes and the lamp thus operated, shining through the clear red liquid, will furnish the illumination required. To open or close the circuit it is only necessary to lift the zinc rod from the solution or reimmerse it, as the case may be.



An ingenious electric lamp for the dark-room



Two views of the punch press that is different from all others

A New Idea in Dieing Machinery

IT has remained for an American inventor to cast aside the conventional ideas about metal dieing machines which have prevailed for the past fifty years or more, and to design a machine along entirely new lines. As a result, there has been evolved a machine that represents some remarkable improvements in the dieing of sheet metal, and also in blanking, piercing, forming, coining, and drawing.

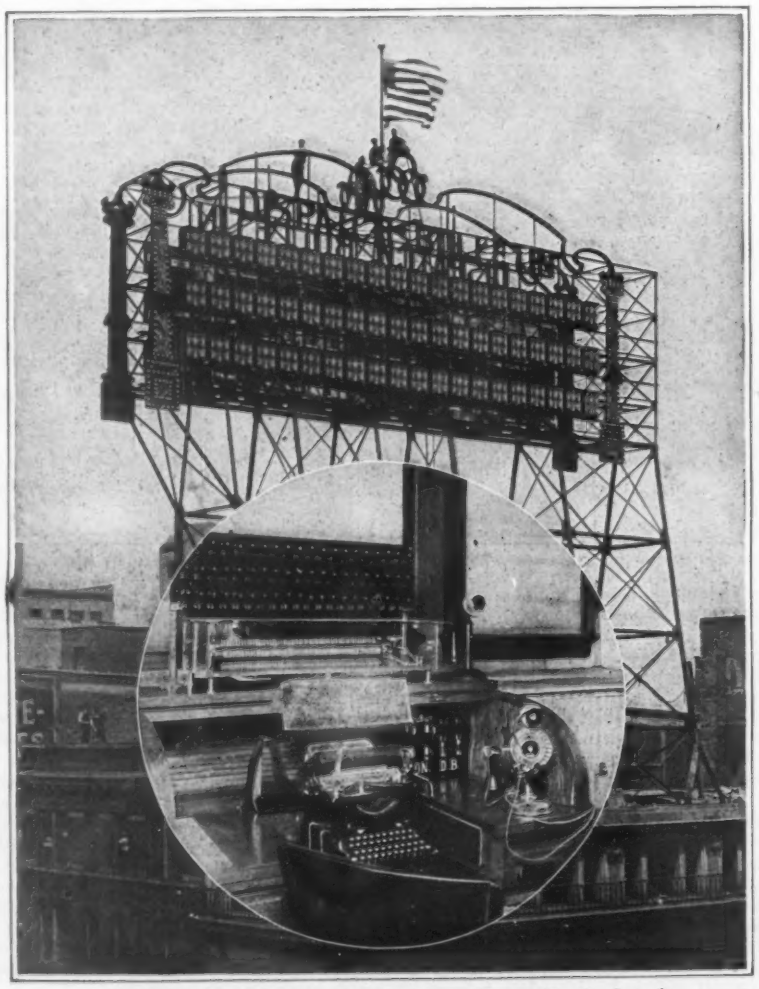
There being no torsional or ripping strains throughout the machine, the strains being wholly tensile and compressive, the danger of injury to the machine through overloading is almost entirely eliminated; and because of the fact that it is impossible for the dies to be thrown out of perfect alinement with each other, they should last several times as long as usual, remain sharp for a longer period, and therefore, give more perfect edges to the work. In blanking the burrs should be eliminated to a great extent. These claims are not theoretical, but are based on a comparison between the well-known result obtained by the use of dies in the device known as a sub-press and those used in open-face machines.

The driving mechanism of the new machine is all located below the die plates instead of above as in the older machines, thus not only doing away with the great obstruction to light, which has always been a fault with these machines, but the machine is in better balance and can be constructed with very much less weight for the same strength as heretofore.

The design of the new machine lends itself easily to the use of various attachments such as finger motions, automatic feeding mechanisms, scrap cutters, dial feeding mechanisms, etc. As will be readily seen, the posts form a natural hub for the attachment of dial feeding devices, and there are many ways in which these machines, on account of their compact design, may be used in groups to advantage over other existing machines, such as the placing of a line of machines under a bench of the height of the dies and operated by belts attached to pulleys on a line shaft underneath the bench.

The inventor of the new dieing machine claims to have overcome all the objections of other dieing machines. It will be noted that it is very much easier to set the dies accurately than in the older types, as it is merely necessary to set the shank of the upper die holder through the top plate, tighten up the bolt which draws it up, fit the lower die to the upper one, lower the frame so that the lower die fits into the die bed, and adjust the depth guard into position required.

The floor space required by the new machine is much less than that needed for other designs, and there is no moving mechanism for the operator to come in contact with. While it is generally conceded that other machines used in the dieing of metal are among the most dangerous employed in the art of metal working, the inventor claims that the safety device used on his machine makes it impossible for an operator to start the dies while his hand is in a dangerous position. The safety device consists of a cage which fits entirely over the top of the machine, and this cage must be raised in order to get a hand or finger between the dies. When the cage is raised, however, the machine is locked and cannot be operated until the cage is lowered, in which position it is provided with holes sufficiently large for the metal to be passed through but not large enough for the entrance of a finger or hand.



Writing bulletins in letters of fire from a typewriter keyboard

. . . and at big R.R. stations in New York, Chicago, etc., etc.

A fact:

From railway news stands sales reports received by us last month, the following extracts are printed as evidence that —with a large part of the traveling public, at least—the preference for Fatima is equally strong, East and West:

NEW YORK—Pennsylvania Terminal: "Fatima remains by far biggest seller"
NEW YORK—Grand Central Station: "Fatima outsells any other brand"
CHICAGO—Park Row Station: "Fatima is the leading seller"
CHICAGO—Union Station: "Fatima leads all other high-class brands in sales"
CHICAGO—La Salle St. Depot: "Fatima is best seller among the better brands"
PHILADELPHIA—Broad St. Station: "Fatima is second best seller"
ATLANTIC CITY—Reading Station: "Fatima is biggest-selling cigarette"
ATLANTIC CITY—Penn. Station: "Fatima is best seller"
CINCINNATI—Grand Central, Penn., B. & O. Depots: "Fatima outsells all other brands"
DETROIT—Union Depot: "Fatima still leads all other brands in sales"
DETROIT—Michigan Central R.R. Station: "Fatima sales are highest"
Trains of N.Y., N.H. & H.R.R. System: "More Fatimas are sold than any other cigarette"
BUFFALO—N. Y. Central Station: "Fatima is largest-selling cigarette"

FATIMA
A Sensible Cigarette

The fact is that, besides pleasing the taste, Fatimas leave a man feeling clear and keen-minded, while and after smoking.

Liggett & Myers Tobacco Co.

Save the tin-foil from the Fatima package and give it to the Red Cross

RECENTLY PATENTED INVENTIONS

Pertaining to Apparel

NECKTIE.—T. C. SAVARESE, 227 E. 118th St., New York, N. Y. This invention relates to bow ties, it has for its principal object to provide a tie so constructed that both ends can be brought to the front of the bow so as to make a neat and more attractive appearance. A more specific object is to provide a necktie which has in one end a pair of spaced button-holes which are adapted to register so that the end of the tie which ordinarily lies behind the bow can be brought to the front.

CAMISOLE LACE FABRIC.—H C. HUCKNALL, Elyria, Ohio. The invention relates to a lace fabric for making camisoles. The object is to provide a camisole fabric which is made of one piece of lace which is sold in strip form with cut-out portions along the top of the strip, whereby the remaining portions constitute shoulder straps, the corresponding ones of which are tied together by a bow, the strip including therefor the body, the beading, the bottom edging and the shoulder straps.

Pertaining to Aviation

AIRSHIP.—G. PETTIGREW, 2111 So. J St., Elwood, Ind. An object of the invention is to provide an airship having a plurality of impeller wheels, the blades of the propeller wheels having reciprocating shutters operated by cams to open the shutters on the up-stroke and close them on the down-stroke. Another object is to provide an airship including impeller wheels with an engine for operating the same, and a propeller with a separate engine for operating the propeller, the engines being independently controlled by the operator, so that the ascent and forward movement of the airship may be obtained as the operator desires.

ARMATURE CORE SUPPORT.—A. N. SAMMARONE, 1922 E. 120th St., Cleveland, Ohio. An object of this invention is to provide an armature core support which is made of pressed steel metal parts secured together in such a manner that a circulation of air is maintained thereby cooling the core. The support is strong in comparison with its weight, and so formed that the core may be placed on the support or removed from it with the greatest facility.

Electrical Devices

ELECTRIC LIGHTER FOR OXY-ACETYLENE TORCHES.—A. M. LOFSTROM, Cambridge, Minn. The invention has for its general object to provide an electric igniter which is especially adapted for lighting the flame of an oxy-acetylene torch. A more specific object is the provision of an igniter having spaced terminals connected in circuit with a source of current and a coil, so that a jump spark will cause the gas to be ignited, thus doing away with the necessity of matches.

Of Interest to Farmers

TRACTOR PLOW.—J. C. GARROTT, 2405 Arunah St., Baltimore, Md. An object of this invention is to provide a tractor plow which includes a plow truck having plow carrying means on each end, and which is movable between two anchorages at the extremities of a plot of land to be plowed. Another object is to provide an extension bar with a clamp device for clamping the bar onto a movable cable by which the plow truck is pulled across the field, the plow truck is provided with right and left hand plows which are adjustable.

HAY STACKER.—J. H. MCDANIEL, Wood Lake, Neb. The invention relates particularly to a readily portable apparatus which may be set up at any desired point. An object of the invention is to provide a machine which, while resting directly upon the ground in use, may be elevated and wheeled, from place to place. A further object is to provide a machine having a stack forming cage which may be folded when in disuse, within the limits of the machine.

CULTIVATOR.—W. J. WILSON, Buckholts, Texas. The invention relates to wheel cultivators and particularly to what is known as seat guide cultivators in which the plow beams are guided by a lateral movement of the seat and pressure by the driver with his foot against the plow beam at the side toward which the cultivator shovels or plows are to be guided. A more specific object is to effect the guiding of the plow by a relation of the wheel frame, tongue, and the floating plow structure to one another and to the controlling seat.

Of General Interest

PATIENT'S BACK AND HEAD REST.—R. M. RUSSELL, 177 Ridgewood Ave., Brooklyn, N. Y. This invention relates to back and head rests especially adapted for patients, although it may be used by others to support the back or head at any angle of inclination while the patient is lying on a bed or cot. The general object of the device is that it be so constructed as to be easily folded or unfolded, adjusted to different positions, durable and substantial in construction and thoroughly sanitary.

ELASTIC LINK.—J. J. JACOBS, Hotel Alton, Salt Lake City, Utah. The object of this invention is to provide an elastic link more especially designed for use on belts, suspenders and like articles. In order to accomplish the desired result, use is made of a U-shaped frame provided with guideways in its parallel arms, a spring seated on the closed end of the frame and guided in the guideways, and a loop straddling the free end of the spring and the closed end of the frame.

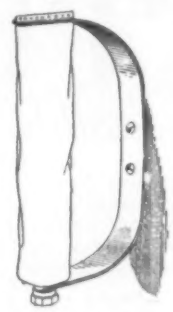
FILM MASK FOR CAMERAS.—R. S. BURDETTE, Capt. Ordnance Dept., U. S. A., Gorgas, Ala. This invention relates to film cameras of that type containing attachments for adapting the camera for films of different sizes. A specific object is the provision of a mask in the form of a plate having an exposure opening and provided with means for retaining it in proper position in the frame of the camera and for certain forms of camera the mask contains a flap which lies between the camera back and the film and serves to maintain the latter in the proper focal plane.

IRRIGATION DEVICE.—C. S. HOWARD, Brownsville, Texas. The invention relates to an irrigation device comprising a swivel joint whereby the inlet may be quickly placed into operative or inoperative position and thereby the flow controlled. An object is to provide a simple arrangement which is water tight and which can be easily manipulated.

DEVICE FOR RENDERING VESSELS UNSINKABLE.—P. ALGER, 9 E. 49th St., New York, N. Y. The general object of the invention is to provide effective means in the form of floats applied to the outside of the hull of a vessel in such manner that the speed of the vessel is not materially affected when the floats are in normal position close to the sides of the hull, as in traveling through waters not infested with submarines, and which can be adjusted to an outstanding position with respect to the hull when in danger zones, whereby the buoyancy floats will become effective for keeping the vessel afloat if the hull is struck by a torpedo.

FINDER FOR CAMERAS.—F. MATSUI, care of R. Henry Depew, 1019 Hilside Ave., Plainfield, N. J. The invention relates to photographic cameras of the type in which plates or films are employed to receive the negative impression to produce an oblong picture having its longer axis either horizontal or vertical, and having associated with the camera a miniature camera or finder so arranged as to indicate to the operator a view proportional in width and height to the desired picture irrespective of whether the camera is arranged for a horizontal or an upright picture.

TUBE HOLDER.—W. J. A. BRAND, 74 Van Dyke St., Brooklyn, N. Y. This invention relates to supporting devices for containers and has for its object the provision of a construction for holding a tube in place in such manner that the



PERSPECTIVE VIEW OF DEVICE WITH TUBE MOUNTED THEREIN

contents may be forced therefrom while the tube remains in a given position. Another object is to provide a resilient support engaging the ends of a collapsible tube for holding the tube substantially taut while allowing the tube to be collapsed for removing the contents.

ICE CREAM CUTTER —C. E. PHENICIE, 111 E. 34th St., Tacoma, Wash. The object of this invention is to provide an ice cream cutter more especially designed to cut ice cream into bricks. Another object is to permit of cutting the ice cream brick into slices. Another object is to insure accurate cutting of the ice cream with a view to form bricks or slices of a uniform size.

REVERSIBLE CLUTCH.—A. H. GRUNTLER, Wethersfield, Conn., R.F.D., No.1. The invention relates to a reversible clutch of the frictional type. The device comprises a driving member, a driven member, friction cones for coupling the driving and driven members, a friction disk constrained to revolve with the driving member, a friction disk separated from and moving with the friction cone of the driven member, friction rollers interposed between the friction cones adapted to control the friction disks substantially.

BELT FASTENER.—E. SEAVEY, 359 Pearl St., New York, N. Y. The object of the invention is to provide a belt fastener arranged to firmly unite the ends of the belt and to provide a smooth under surface to insure an easy passage of the belt joint over the pulley surfaces. This is accomplished by the use of stuck-up apertured bosses, the bosses being driven into the belt material, and tacks driven through the bosses and clenched on the under side of the belt.

CARTRIDGE FOR SHOTGUNS.—W. H. WOODHOUSE, Box 287 Boulder, Col. The prime object of the invention is to provide a cartridge having a composite projectile charge in which the core or central portion of the charge will be composed of larger shot to constitute the effective charge at a maximum distance, together with a convoying surrounding mass of smaller shot which serves to retard the scattering of the larger shot during a part of the trajectory.

COLLAPSIBLE FORM FOR MOLDING CONCRETE VESSELS.—A. W. BULL, care of Samuel M. Gardenhue, 49 Wall St., New York, N. Y. The invention relates more particularly to collapsible forms for building the hull of a vessel either monolithically or in successive sections by using a plurality of collapsible form units which can be easily and quickly assembled in position for pouring the concrete and after the concrete has sufficiently hardened, the forms may be collapsed, withdrawn and shifted for another section or another vessel.

ALLOY.—F. MILLIKEN, 55 John St., New York, N. Y. The invention relates to an alloy of a number of different metals, and when cast, is black or very dark in color. An object is to produce an alloy which is non-corrosive, which is capable of being polished, and which will not require cleaning; the alloy can be used for all purposes where brass and bronze are now used. The alloy contains metals in substantially the following proportions, copper 60 per cent, nickel 6 per cent, iron 4 per cent, zinc 12 per cent, lead 2 per cent and a trace of phosphorus.

SEWING CABINET.—H. LEACH, Mount Carmel, Ill. This invention relates to cabinets designed for use especially by seamstresses; it has particular reference to a simple and compact article adapted to hold the various tools and supplies in a readily accessible manner. Among the objects is to provide a cabinet adapted to be supported against a wall or upon a suitable base, including in its assemblage compartments for needles, pins, thimbles, scissors, yarn, cotton or thread, buttons, hooks and eyes, etc.

IRONING BOARD.—A. MINTZ, 473 E. Houston St., New York, N. Y. An object of the invention is to provide such a board as would obviate the necessity of using a number of different boards for ironing different parts of a garment. A further object is to provide a board having a detachable top so that the bottom of the board may also be used for the purpose of ironing certain parts of a garment which are at present ironed on tables.

LIQUID CONTAINER SUPPORT.—H. W. BILLARD, 4865 Beaufort Ave., Richmond Hill, L. I., N. Y. Among the principal objects which the present invention has in view are to provide a device for preventing the upsetting of ink wells or other liquid containers; The support comprises a sheet metal tray, having a central depressed well, a pendent annular flange, hook sections, and a spring wire loop, the loop being adapted to engage the hook sections, and extend across an object disposed in the well.

FOLDING BOX FORM.—J. S. CRATE, 902 Goggan Bldg., Houston, Texas. A specific object of the invention is the provision of a form composed of a plurality of sections hingedly connected together so that the form can be conveniently handled or stored away, there being slits between the ends of the sections to enable the blank to be slit at these points to form the end flaps of the box, and if desired, one of the sections may have a stencil whereby the proprietor or firm name may be printed on the box blank.

INK WELL.—J. I. D. BRISTOL, Villa Perry, Perry Heights Chappaqua, N. Y. Among the objects of the invention is to provide an ink well constituting a reservoir for the ink into which a tubular stem projects from a plunger or top, the top having a downwardly projecting outer flange spaced laterally from the tube and an intermediate downwardly projecting flange projecting below the edge of the first mentioned flange and into a sealing fluid contained in an annular cistern in the upper portion of the base structure, the rim portion of the cistern being formed to prevent splashing or spilling.

BUILDING BLOCK.—C. BAUM, Sweetsers, Ind. The invention has for its object to provide a hollow block especially adapted for building granaries, grain bins, and the like, wherein perfect ventilation is provided for the block and for the bin or wall, the openings on the faces of the block are small and inclined upwardly toward the interior of the block, thus preventing the entrance of mice, moisture and the like, or the escape of the grain.

LIQUID RECEPTACLE AND EJECTING DEVICE.—M. E. BRINSER, York, Pa. An object of the invention is to provide a receptacle which may be entirely filled with liquid but which is provided with a spring designed to move a piston in such a manner that one half of the liquid may be ejected and the other half may be ejected subsequently upon the retraction of the spring by manual means, the device is automatic and may be controlled at any point in this movement manually.

QUILT FASTENER.—S. M. HOPPER, Hays, Kans. The invention has for its object to provide mechanism for holding a quilt in the quilting frame without the necessity of sewing the quilt to the frame. The device consists of clamping plates secured at regular intervals to the quilting frame for supporting the edge of the quilt, the clamps are so constructed that while they hold the quilt firmly in the frame, it may be easily released.

WASHBOILER.—G. H. LEMKE, Zumbro Falls, Minn. The object of this invention is to provide an attachment for boilers which may be detachably connected with the top of the boiler, and which carries means for lowering and raising a rack or basket of garments into and out of the water in the boiler. In use the rack is lifted until the bottom is above the water in the boiler, the garments are then laid in, the rack is raised and lowered by means of a shaft flexible members and a crank.

OIL CUP.—J. W. PARKS, Austin, Texas. The invention has for its object to provide a device, especially adapted for jeweler's use, wherein the receptacle for the oil is supported in a casing having a cover for the receptacle hinged to the casing, and carrying a holder for the oiler, the cover being normally spring pressed into open position, and being connected to mechanism controlled by the insertion of the oiler in the holder for closing the cover and holding it closed.

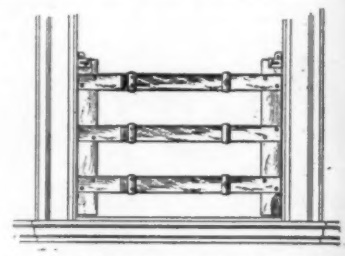
PACKLESS ANTIDRIP VALVE.—J. C. SMITH, care of Foster Milliken, 55 John St., New York, N. Y. The object of the invention is to provide valve mechanism which may be quickly opened and closed, and which has a special structure including a gasket for preventing leaking. Additional objects are the provision of a spring for always holding the parts in proper position to prevent leakage, and a handle which cannot be depressed to cause leakage.

MANUAL TENSION METER.—J. E. CROWELL, Matthews, N. C. The invention relates to a manual instrument for measuring the tension to which wire is subjected. The device is characterized by the provision of a carrier frame having a span within which a portion of the wire, the tension of which is to be tested, is engaged, and a measuring device mounted on the frame to indicate the tension the wire is subjected to.

ASH SIFTER.—P. KEMPLER, 86 So. Water St., Newburgh, N. Y. An object of this invention is to provide a device adapted to rest on ash cans or barrels, and which will permit the handling of ashes without scattering the dust that may result not only in sifting the ashes but in placing the ashes in the sifter. Other objects are to provide a device which can be easily removed from the barrel supporting it, and which can be adapted to different sizes of barrels.

BOOK COVER PROTECTOR.—ELIZABETH L. ROWLES, Goodhue, R. 6, Minnesota. The object of this invention is to provide a book cover protector which is flexible, designed to extend about the entire outer surface of the sides and back of the book, reinforcing tabs are provided to protect the corners of the sides, and a reinforcing strip to protect the back, the latter engaging the back to prevent accidental displacement of the cover during the opening and closing movement of the book. The main object is to provide a device which is simple, compact and durable, neat in appearance and can be manufactured at a very low cost.

RAILED BARRIER.—D. B. BUDIN, 696 Warren St., Brooklyn, N. Y. Among the principal objects which the invention has in view, are to prevent the accidental dislodgement of a barrier, and to simplify the construction and assembly of the same. The invention is intended for use in connection with window openings and door openings. One of the chief purposes is to prevent the accidental falling from a window when a person is spreading or collecting laundry.



A FACE VIEW OF BARRIER, ARRANGED IN ACCORDANCE WITH INVENTION

WASHTUB COVER.—A. BRIENZA, 145 Blackford Ave., Port Richmond, S. I., N. Y. The objects of this invention are to provide a washtub cover which is exceedingly strong and durable, not liable to warp or bend out of shape and capable of sustaining considerable weight thus permitting the use of the cover as a shelf when the washtub is not in use. Another object is to provide a cover which is perfectly smooth at the top and devoid of sharp edges at the sides and bottom.

INSECT DESTROYER.—J. M. MADDEN, 311 2d Ave., New York, N. Y. Among the objects of the invention is to provide a commercial container adapted to be sold on the market filled with the commodity contained therein in suitable form to be dispensed directly from the container, the container comprising facilities for forcibly ejecting therefrom small quantities of dry dustlike or powdered material into the crevices or hiding places for the insects.

DECOLORIZER.—P. A. BOECK, 11 Broadway, New York, N.Y. An object of the invention is to form a decolorizer from infusorial earth by calcining it. A further object is to form a decolorizer of infusorial earth and fuller's earth, whereby the efficiency of the fuller's earth is increased due to the presence of the infusorial earth, as the infusorial earth, in addition to helping to decolorize increases a larger surface of the fuller's earth to the substance to be decolorized.

COMPOSITION FOR PREVENTING SMUT OF PRINTING INK.—C. H. RACKLE, 2314 Broadway, New York, N. Y. The invention relates to a mixture which, when added to printing ink will prevent what is termed in the printing industry "offset or smut." It will also prevent printing sheets from sticking together. The mixture is formed of mutton tallow, fluid varnish, cornstarch, paraffin oil, and oil of citronella. The ingredients are used in substantially the following proportions: tallow 7 pounds, varnish 2.75 pounds, starch 2 pounds, paraffin oil 1 pound, and oil of citronella 2 ounces.

WINDOW CONSTRUCTION.—A. MACKINNON, Hillcrest, Tuckahoe, N. Y. The general objects of the invention are to simplify structures of this character so as to be of durable and substantial form, and so designed as to insure rain-wind- and dust-proofness. More specific objects are to provide means for suspending the sashes so that they can be revolubly suspended directly on the counterbalance weight chains, and to provide a screen slidably mounted in the window frame and lying between the window sashes so as to take the place of the usual parting strip.

HOLDING DEVICE FOR VIBRATORS.—P. GIGLIO, address John Sabatino, 4757 Jerome Ave., Richmond Hill, L. I., N. Y. This invention has for an object to provide a construction whereby the device may be readily clamped to

(*Continued on page 446*)

Reconstructing Ocean Highways After the War

(Continued from page 437)

follows across the high seas, it must concentrate in places designed by nature as the meeting points of land and water transit.

The world knows a number of such danger points, the principal ones being the ports of eastern Asia and those of the Plata River in South America. Ship owners and ship users fear the periods of congestion at these points as much as they dread an undersupply of tonnage at the same centers. The causes of either calamity are to be found in faulty distribution of the world's shipping. Their effects are the same all over the globe, and may be well illustrated by a single example—that of the United States.

During the year 1913 we exported to Brazil merchandise valued at $42,000,000 and brought back a bill of $13,000,000. In the case of Chile we exported $16,000,000 and imported $27,000,000. Germany received American merchandise valued at $331,000,000 and was able to sell us only $188,000,000 worth. We sent to England goods valued at $597,000,000 and bought from her $295,000,000. In general, even allowing for discrepancies between value, bulk and weight, it is clear that more ships will be required to carry our goods to Europe than Europe will need to send us what she sells us; while in the case of South America we must use more vessels on the north bound journey than on the south bound. To satisfy the European demands we must have empty ships in American ports; to satisfy our own wants we must provide empty ships to South America.

As a matter of fact, only 12,000,000 tons of shipping are required to carry European goods to our ports, while we need 19,000,000 tons to send our products to Europe. South America needs 3,500,000 tons to send her products to us, and we can use only 2,000,000 tons for the return shipments. The actual waste of shipping space for the entire world is estimated at 60,000,000.

Now it stands to reason that if we could but systematize the shipping routes, much of the empty shipping could be eliminated. To effect this, the application to ocean transportation of the railroad trunk-line methods has been recommended. Shipping for this purpose would have to be divided into three large groups. First we would have the fast passenger steamers, the Pullman trains of the ocean; next the through freighters, corresponding to the fast through freight trains on land; finally the remaining slow shipping—tramps, sailing vessels and others. The passenger ships would be run about as now; and like their railroad counterparts, they would carry, in addition to their human freight, mail and express shipments of all sorts, just as now they do. The rates for this service could be easily fixed, as could the tonnage requirements.

Fast freight carriers, which would include most of the fabricated ships now built by the United States Government, with practically all the modern freight carriers, should be routed in a series of belt lines running around the world in both easterly and westerly directions. Each of these lines should be provided with sufficient tonnage to carry all the freight on its route. One line might run from New York to British ports, thence via the Mediterranean to India, and back to New York through the Panama Canal. To provide for the tremendous demand for east-bound tonnage out of New York, a second line could be directed to some other European port, calling also in the Mediterranean, and running thence so as to serve Australian or Chinese trade with America in returning. A third line could go from New York to South Africa and return via Australia or any other eastern market as required. In turn, New York shipping would run in westerly direction to China, Africa and Australia, with deviations to the South American ports. All these ships would run on schedule.

The remaining slow shipping could then be used to fill out the gaps and to act as feeders for the principa llines. Like coastwise shipping, it would carry goods to markets and from producing centers too small to be visited regularly by the big freight carriers. These hauls would be made merely to or from the large ports of the world, where transfer would be made to or from the regular freight carriers serving the leading lines. To be sure, it costs money to trans-ship; but not so much as to haul empty ships thousands of miles to a point where they can get a cargo. Every other agency of transportation has found the feeder system the most economical one; why not apply it on water as well as on land?

The plan may take some years to complete. There will be difficulties to be overcome in its execution; but if well carried out it will go far toward stabilizing shipping rates and doing away with shipping waste. Not only will there be sufficient shipping for all international commerce, but the very fact of the existence of a regular shipping service of this character will at once encourage the world's producers to make a better use of the existing transportation facilities. There will no longer be unemployed tonnage, no longer need for the world's merchants to wait for shipping to carry their products to the world's markets.

The war has taught the nations much with regard to national organization. It is now time that the principles that have been so successfully employed within each national household were applied also in the international field where they can be made use of to the benefit of all.

The American Pacific Ocean

(Continued from page 441)

case of the very smallest birds, an occasional marauding mouse.

Some of the changes in the island species of birds are due, doubtless, to inbreeding. Life on these islands seems to have tended to produce birds of greater total length, with heavier bills, and heavier tarsus and feet. The length of the wing and tail remains about the same as on the mainland, but the coloration becomes darker, with brighter colors and heavier streaking.

An annual feature is the spring migration of the Pacific loon, which after wintering on the islands go flying northward by thousands, in detached companies of from a half dozen to thirty individuals, all following exactly the same line of flight, or pausing to feed on the spawning smelt, in the little coves on the shores of the islands. The rhinoceros auklet is an expert swimmer and can proceed under water for nearly a thousand feet. The cassin auklet undermines the soft, earthy surface of Santa Barbara Island with innumerable burrows. The black petrels about Anacapa lay their eggs among the boulders on the bare ground. When removed from this crude nest, the old bird punishes the intruder by vomiting a 4-foot stream, or savagely biting at her captor's fingers, or, in her frenzy, even at her own wings. They feed their young by regurgitation. For their own food they like best of all the young of the rock lobster.

These islands boast one of the rarest birds in America, a certain sub-species of island shrike, one of the very shyest of all small land birds. The island shrike can match any strategy. It is almost hopeless to try to get within gunshot of one, for even the alarmed shrieking of their own offspring will fail to bring them to the rescue. When the father of one family and the mother of another were captured, the widow and widower, two days later, were found to have combined forces in rearing together the young of the second nest. When the twice-married husband was captured, the loyal and devoted stepmother continued with the utmost fidelity to feed her adopted children.

Testing Soils by Testing Assimilation in Plants

THE chemical analysis of soils is a familiar method of determining their agricultural fitness for various crops. However, just as an animal may have food which is abundant and yet of such nature as not to be assimilable, so the health and growth of a plant are dependent on its power of assimilation of the mineral elements present in any given piece of ground. These considerations have led Swiss agricultural experts to employ a special method of studying the fertility of soils, especially in the case of the meadows which are so important a part of that land of milch kine. According to *La Terre Vandoise* this consists in an analysis of the crops, especially of the hay harvested at the beginning of the flowering season or slightly previous. For this purpose a specimen containing at least 10 kilograms (22 pounds) is collected by taking handfuls at regular distances along the windrows. Obviously such an analysis shows what elements the plant is able to extract from the soil, in other words the percentage of assimilable substances. It is clear, however, that the value of the method must depend largely on the making of an extensive series of observations, comprising botanical species, soils, and location.

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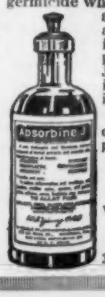

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RECENTLY PATENTED INVENTIONS

(*Continued from page 444*)

the hand so as to transmit all of the vibrations from the vibrator to the hand. A still further object is to provide a construction in which a single clamping piece may be utilized for causing the holder to firmly grip the hand without injury thereto.

WATERING POT.—A. E. WILT, care of Mrs. M. D. Wilt, 612 W. Horthen St., Germantown, Pa. The invention relates to watering pots for plants, etc., the main object is to do away with the necessity of holding the pot with the hands under a spigot or hydrant, with the attendant probability of being splashed with the water, by reason of the water striking the top or guard of the pot. The object is attained by providing an arrangement of filler pipe, with means to couple the same to the faucet, and to the handle and top of the pot.

BALE COCK.—M. H. GREESON, Tampa, Fla. An object of the invention is to provide a bale cock which is mechanically designed to prevent all noise in its action and which will obviate the use of other parts, for instance a choke coil for this purpose. A further object is to provide a bale cock with an automatically closing valve, the movement and operation of which will obviate the usual severe wear, and the sole pressure upon which will result from fluid flowing through the cock.

PRESSURE CONTROLLER.—N. I. GARRISON and H. W. STEELE, address I. Garrison, El Reno, Okla. The invention is especially designed for regulating the flow of gas through a valve in a main so that the pressure in the distributing mains on the outlet side of the valve will be maintained constant, or substantially so. The prime object is to provide a controller which will automatically maintain a uniform pressure on the low side of a gas regulator, regardless of fluctuations on the high pressure side, and which will obivate the necessity of adding or taking off weights, from the regulator.

HOLDER FOR SODA CUPS AND THE LIKE.—D. F. CURTIN, Chicago, Ill. The invention has for its object to provide a rigid holder for holding folded paper cups of conical form, such as are used in soda fountains and like places, wherein a holder proper is provided, supported by a base, the holder proper being of conical shape and having an inwardly offest lip or tongue for engaging a lip or tongue on the blank to hold the blank in place.

ARTIFICIAL LIMB.—DR. A. ZUMAGLINI, Turin, Italy. The invention relates to spring-hinged knees for artificial legs, which are made of cast metal, and possesses the characteristics that it can be regulated, acts automatically, and always retains its natural form regardless of the position of the hinge. The leg includes independent upper and lower members, the upper member having a knee portion having a spherical socket therein, the lower member having a spherical extension at its upper end adapted to fit and oscillate within the socket, and means for resiliently connecting said upper and lower members.

SHIP'S LIFE OR EMERGENCY BOAT.—S. M. JOHNSON, Cardiff, Wales. This invention relates to a foldable structure adapted for use alternatively as a ship's lifeboat or as a deck fitting capable of affording sitting accommodation for passengers, the object of the invention being to provide a structure which, in its enfolded condition, will serve as a pair of back-to-back benches but which can when necessity arises, be instantly converted into a boat and launched overboard without the use of lowering tackles.

TELESCOPE.—L. T. LEBRON, Jr., 125 So. Main St., Galena, Ill. The invention has for its object to provide a telescope consisting of two flat members with lenses which may be placed together in the pocket of a close fitting uniform. One member is cut out to fit the nose of the user and the lens is disposed at one side of the cut out portion, so that when in use, the surface of this member at the other side of the cut out portion will serve as a blind.

SMOKING PIPE.—J. A. IRVING, 335 Broadway, New York, N. Y. The invention has for its object to provide a breech-loading smoking pipe having a body either horizontal or upright with an opening extending from the breech through the bowl to the draft passage. A plug is employed for closing the breech, the plug being longitudinal for the horizontal body, and in angular form for the upright body, a disk is movably mounted on the end of the plug, said disk being attached for the purpose of preventing particles of tobacco from being drawn into and clogging the openings.

MARINE MASONRY CONSTRUCTION.—H. A. ICKE, 1517 Quiadra St., Victoria, B. C., Canada. This invention relates to masonry suitable for a water front bulkhead, quay wall, pier, cofferdam or retaining wall. The general object is to provide a structure which can be economically and easily constructed without unwatering the site or excavating for a foundation, and which is of such design as to possess sufficient elasticity as to prevent fracture or damage by the impact of bodies against it.

Hardware and Tools

LOCK.—I. HAMMER, 886 Prospect Ave., Bronx, N. Y. Among the principal objects which the invention has in view are, to prevent tampering with the lock when actively disposed, to provide a relatively rigid construction, to prevent rattling the lock when actively disposed, and to strengthen the resistance of the lock. The bolts are protected from interference, by reason of the fact that they are inaccessible from the outside of the door, or by a tool forced between the door and the jamb

WORK GRIPPING TOOL.—W. O. VIVARTTAS, 31 King Ave., Weehawken, N. J. Among the principal objects which the invention has in view are, to reduce the time factor of adjustment of the holder on work to be rotated, to provide a tool which increases the grip of the tool on the work in correspondence with the increase of the turning strain, and to provide a holding tool which will not mar the work.

BRACKET.—S. MITTLEBURG, care of The Dollar Store, 126 Clinton St., Johnstown, Pa. This invention has for its object to provide a bracket stamped out of a sheet of metal and which has a band for disposal around a molding, the bracket having a support at one end disposed at the outer side of the molding with a leg extending downwardly, the bracket at its other end being provided with a looped portion for disposal in a groove in the molding.

CHAIN LOCK.—J. C. CLARKSON, Fostoria, Texas. This invention has for its object to provide a device especially adapted for locking one end of a log chain to a car, in such manner that the chain cannot become accidentally released, through shock or jar, but which may be easily released, when desired, from a distance to prevent injury to the operator.

Heating and Lighting

ARTIFICIAL CANDLE.—L. SCHLEPP, care of Genl. Plating Works, 157 Leonard St., New York, N. Y. The object of the invention is to provide an artificial candle, or candle lamp, arranged to provide a permanent substitute for the ordinary candle, and one in which its light supplying means can be readily replenished. To produce this result use is made of a casing adapted to be filled with kerosene or light furnishing fluid, the casing having a closed top in which a tubular wick screws, for holding the wick, which extends into the fluid and beyond the top of the casing.

HEAT INSULATING MATERIAL AND METHOD FOR MANUFACTURING SAME.—P. A. BOECK, care of Olite Products Co., 11 Broadway, N. Y. An object of the invention is to provide an inexpensive heat-insulating composition formed of diatomaceous earth, basic magnesium carbonate and a fibrous binder, in which some of the magnesia enters into the chemical combination with the silica of the diatomaceous earth to form a silicate and thereby increases the strength of the resulting composition and also renders the same suitable for a lining exposed to high temperature.

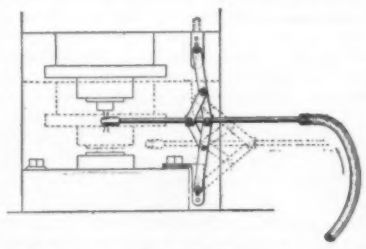
GRATE.—J. H. BROWN, Butte, Mont. One of the principal objects of the invention is to provide a grate in which perforated plates are removably supported on base frames in such manner as to be individually removable for renewal or repair, the construction being such that there is a free circulation of air through and around the plates. Another object is to provide a grate which is simple, durable, and inexpensive to manufacture.

Machines and Mechanical Devices

GRAB HOOK FOR HOISTING MECHANISM.—G. WRIGHT, 358 Academy St., So. Orange, N. J. Among the principal objects of theinvention are, to facilitate the handling of packages of various shapes and sizes, to provide manually controlled means for operating the hook to release the packages when deposited, to expand and contract the grapping members of the hook, the operation being inaugurated and guided to a distance from the object to be engaged.

PORTABLE MOVING PICTURE MACHINE.—F. C. TAYLOR, care of E. K. Frankhauser, 450 Fourth Ave., New York, N. Y. The invention relates to a circuit breaker to automatically cut out the motor, and shut off the illumination, in a moving picture machine so that a broken film may be readily repaired. The film travels through the machine in contact with the circuit breaker, and in case of the breaking of the film the motor is instantly stopped, and the lamp extinguished..

AUTOMATIC BLOWER ATTACHMENT FOR PUNCH PRESSES.—E. CALDERIO, 210 Lincoln Place, Garfield, N. J. The invention relates to attachments for reciprocating die presses, it has particular reference to means for keeping the die from becoming excessively hot and also blowing away and cleaning the die of any dirt, which may have been deposited thereon.



A SIDE ELEVATION SHOWING POSITION OF BLOWER WHEN PRESS IS UP, DOTTED LINES INDICATING DOWNWARD MOVEMENT

Another object is to provide a nozzle with automatic means to move it into position between the active elements of the press when they are separated and back out of the path when the press is making its down stroke.

COPYING LATHE.—G. A. ENSIGN and R. E. KLINGER, Defiance, Ohio. The object of the invention is to provide a copying lathe more especially designed for turning airplane propellers and similar articles which require duplication of parts on opposite sides of a common center. By this device, the work can be readily placed in position on the work holder and the tailstock center and reversed to insure formation of a large number of propellers in a comparatively short time.

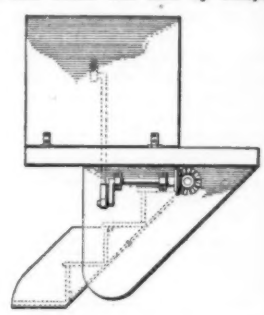
Prime Movers and Their Accessories

GAS ENGINE.—E. NORRBON, 234 61st St. Brooklyn, N. Y. The invention relates to internal combustion engines and has particular reference to facilities for more thoroughly purging the cylinder than is ordinarily customary. An object is to provide a means in connection with the piston whereby a charge of fresh air is taken through the crank casing at each up-stroke of the piston and on the succeeding down-stroke such charge of fresh air is compressed and delivered into the main cylinder so that on the exhaust stroke the charge serves to cleanse the cylinder.

EXPLOSIVE ENGINE.—D. J. MARTIN, 3089 Broadway, New York, N. Y. The general objects of the invention are to provide a construction whereby the crank of the power or working stroke piston will be in its best angular position for receiving the maximum thrust from the explosion of the fuel charge while the latter is at the best degree of compression at the time of ignition, this resultis brought about by an auxiliary piston so constructed as to form with the engine cylinder a fuel mixing chamber into which fuel and air are introduced from a carbureter.

Railways and Their Accessories

EXTENSION STEPS FOR RAILWAY CARS AND THE LIKE.—A. E. SEIBERT, Carson City, Mich. The invention has for its object to provide a step which may be cheaply made and installed, and which will take up comparatively



A SIDE VIEW WITH TRAP LIFTED

little space when in folded position, so that the desired clearance of the steps relative to the road bed is provided, and which is moved into operative position by the lifting of the trap in the vestibule floor.

BLEEDER ROD.—W. W. SMITH, 82 Mussey St., South Portland, Maine. The invention relates particularly to air brakes for freight cars, being directed especially to the means for bleeding air from the brake cylinder after the cars a recut off from the locomotive. The prime object is to provide a rod for bleeding brake cylinders, of such form and in connection with such means that the rod may be held indefinitely in operative position, so as to avoid the necessity of its manual support while the pressure is initially bled from the cylinder.

Pertaining to Recreation

GAME APPARATUS.—A. E. STRADE, 174 Wardwell Ave., W. New Brighton, S. I., N. Y. The object of the invention is to provide a game apparatus having a box divided by partitions into a plurality of compartments, in each of which there are a plurality of recesses, there being a path at the side of the box which terminates in a curved member, so that a ball propelled along the path will be directed by the curved member upwardly and will fall in one of the compartments in which it may roll to one of the recesses.

Pertaining to Vehicles

SHOCK ABSORBER.—G. O. BJORNEBY, 312 Sixth Ave., Kalispell, Mont. The object of the invention is to provide a device adapted for use with motor vehicles, for absorbing the recoil of the springs, to prevent such shock and jar being transmitted to the body of the vehicle. With this absorber, there is no hindrance to the movement of the springs toward each other but an increasing hindrance to their moving apart.

AUTOMATIC AIR CUSHION.—G. W. MACKINNON, Suite 1, 5 Albemarle Chambers, Boston, Mass. This invention relates to cushioning devices for use on automobiles, where one purpose is to avoid shock or recoil incident to the operation of the spring. Among the prime objects is to provide a means whereby the action and recoil of the springs is cushioned pneumatically by automatic devices associated with the springs.

SHOCK ABSORBER FOR VEHICLES.—S. A. BURROWS, address Wm. Overton, 67 W. 104th St., New York, N. Y. This invention relates to shock absorbers of the flexible type adapted to cooperate with the spring suspension of a vehicle. The object is to provide an inexpensive shock absorber which can be easily attached to the spring suspension of an automobile and which will prevent the side sway of the body with relation to its spring, at the same time serving as a shock to undue reaction of the vehicle suspension.

Designs

DESIGN FOR A LAMP SHADE OR SIMILAR PLAITED ARTICLE.—A. KRAUSS, address Louis Levi, 880 Broadway, New York, N. Y.

DESIGN FOR BADGE OR SIMILAR ORNAMENT.—M. C BARNARD, Phoenix, Ariz.

DESIGN FOR AN ASH TRAY AND CIGAR CUTTER.—I. BLUMENTHAL, 79 E. 121 St., New York, N. Y. This ornamental design represents an airplane.

The Current Supplement

IT is very easy for sentimental theorists, who stay at home and cannot realize what war really means, to condone Germany's offences. The wanton destruction of other people's homes means nothing to them, and an acknowledgement of the character of German methods would seriously interfere with their pedantic theories, so presentation of facts has little effect on the "peace propaganda" that has been cautiously advocated, sometimes by people of prominence. Our men in France and Belgium know, however, from actual observation what Hun occupation means; and the camera brings evidence in a form that cannot be controverted. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2239, for November 30th, will be found an article by a prominent American, entitled *A Visit to the British Front in September*, which gives recent observations of the condition of cities in northern France, and it is accompanied by photographs that clearly indicate how hopeless is any sympathy with the people of Germany. *Life and Light* is an extremely interesting paper that deals with the processes by which living organisms produce light. *A Silky Eater of Ants* is a very readable article that tells of a curious little animal of peculiar tastes and habits, and it is illustrated by a number of attractive pictures. *A New Method of Separating Slate from Coal* describes and illustrates an apparatus based on an entirely new and original principle that promises to work important economies in the more complete utilization of coal. *Meteorology in Relation to Aeronautics* reviews the intricate data required by aviators, a matter that will be fully as important in commercial work as in war maneuvers. Other articles include *The Ferro Alloys; Food Shortage and High Prices; Pneumonia as a Public Health Problem; Scientific Plant Breeding*, and *The Relation of Light to Health*.

Radio Communications and the Great War

AS a means of communication, wireless telegraphy and wireless telephony have played a role second to none in the great war. Indeed, it was most fortunate for belligerents and neutrals alike that the art of radio communication had reached such a state of relative perfection at the outbreak of hostilities that it could be depended upon to relieve the heavily-burdened cables in handling a fair share of the transatlantic commercial and diplomatic traffic, as well as the ever-increasing volume of press matter. Again, wireless communication was largely employed on the many battlefields and in the skies between fleets of airplanes and artillery officers and staff headquarters. The first news of the signing of the armistice came by wireless, and much of the business incident to the armistice was handled by radio. In obtaining news from Russia and Germany the Allies have had to depend on wireless. All in all, wireless communication has been indispensable.

With the conditions that pledged wireless men to absolute secrecy no longer prevailing, we are now beginning to hear of some of the wonders that have been effected in this branch of communication. It appears that wireless telegraphy has been developed to an undreamed-of state of perfection here in America, while wireless telephony is now available for use between ground stations and airplanes with excellent results.

Ever since the genius of Marconi made wireless telegraphy a fact, the only limitation of this method of communication has been the deadly phenomenon of static conditions. It was "static"—the presence of a large amount of uncontrolled electricity in the air—that at the beginning of the war often entirely prostrated the wireless service even between the most powerful stations erected in Europe and America. Static conditions were responsible for abnormal delays, and for the mutilation of words in wireless messages

Static has always been the *bête noir* of radio operators. It proved such a great obstacle to continuous communication by wireless that Marconi issued a personal appeal to every operator in the world to record his observations and to collect data on the subject. Some of the leading scientific minds struggled to overcome the effects of static disturbances. World-wide researches were instituted and large sums of money expended; but the end sought was not attained.

So it remained for an American radio expert, Roy A. Weagant, Chief Engineer of the Marconi Wireless Telegraph Company of America, to discover the solution of the static problem. Weagant practically devoted his life to a study of this perplexing phenomenon, and the result of 15 years of experimental work was about to be published to the world when the United States entered the great war.

Although patent applications had been made and the claims allowed by the United States Patent Office, the Weagant system was immediately placed at the disposal of the Government, and every precaution was taken to keep the invention secret until the discovery could be safely announced. With the spirit of research that has made the Navy such a magnificent arm of our military service, officials of the Navy Department assigned naval experts to coöperate with the inventor in installing experimental stations in various parts of the country. The stations are now receiving messages from all the high-power wireless stations of the world.

With the consent of the Marconi Company, the United States Navy Department disclosed the Weagant invention to our Allies; and special representatives of the French and British governments were sent here to study the system.

Among the revolutionary changes that the new system effects in wireless installations will be the immediate disappearance of the huge steel towers heretofore built to great heights in order to intercept the radio waves. Equipped with the Weagant invention, the wireless antennae are stretched merely a few feet above the ground. Also, it is announced, the troublesome feature of interference which has been increasingly serious with the multiplying of wireless stations, is now eliminated because the Weagant system is based on a unique selective principle. Messages from any desired station can now be intercepted despite the operation of other stations operating in the immediate vicinity.

Mr. Weagant, who has been a distinguished radio engineer for 15 years, is only 37 years old. He is a graduate of McGill University in Canada and a Fellow of the Institute of Radio Engineers.

Canadian Whale-Canning Establishment

A CANADIAN whaling company has been canning whale meat for a number of months in British Columbia. In a letter to the Commercial Intelligence Branch of the Canadian Department of Trade and Commerce, it says:

"Owing to the demand for whale meat for food we have erected a cannery where we expect to pack 30,000 to 50,000 cases of whale meat this season. We have also erected three cold-storage plants to handle frozen whale meat. We also own and operate two freight steamers, one of which has a cold-storage capacity of 500 tons. The species of whales taken on this coast yields three to twelve tons of prime meat, and only the prime meat is used by us at the present time for canning or freezing for food. At our plants the meat is handled in an absolutely sanitary manner, and to this end we have gone to considerable expense. Owing to the whale being a hot-blooded mammal, many of the whales brought into our stations are unfit for food, as they are sometimes captured at great distances from the stations, and the whales that have been killed over 24 hours are not used for this purpose. Samples of our canned product are only now being sent out to prospective buyers, and we have not at present made any large sales in Canada or in the United States, although we have shipped 1,000 orders for over 1,000 tons, the bulk of which is now being shipped to Boston. Our whaling season opens about April 1st and ends about October 15th. Up to the present we have put up about 18,000 cases of meat at our cannery."

Latest Patent Decisions

Extent of Infringement.—Where complainant's invention represented an entire revision of a machine and the creation of a new device in which all of the operative parts contributed to produce a new result, the complainant may recover for defendant to prove what old element, if any, contributed to the profits.—*Oehring v. Fox Typewriter Co. U. S. C. C. A. of N. Y.*

Interest in Infringement Award.—In an infringement suit where profits are awarded, interest is not allowed until the amount has been judicially determined, **but** interest is allowed from the date when the infringer would have paid royalty, if licensed, where the damages are measured by established royalty, and that rule is

Colt's Firearms

1848 1898

have been supplied to the United States Government for many years. Troops were equipped with Colt made arms in the Mexican War, 1848, during the great struggle from 1861 to 1865, and in the war with Spain, 1898. Through all the years of this Company's existence we have been developing arms which have been adopted by the United States Government and which have made many thousands of friends for the Colt Company.

This great experience now seems to have been but preparation to enable us to serve the United States Government during the present world war. The Colt Company manufactures the Colt, Browning and Vickers Machine Guns in addition to the Colt Automatic Pistol and Colt Revolver, Caliber .45. To the maximum extent of our capacity we are making these essentially military weapons for the Government, and at their request are daily enlarging our facilities. In doing this, which is our duty to the Government, we are each day having to disappoint many friends who wish to procure some particular model of Colt revolver or automatic pistol for their own use. We are sure, however, that all those who have the best interests of the country at heart prefer that at this time our whole effort be expended in making our part of the equipment for the boys who are going to use it "over there."

1861 1918

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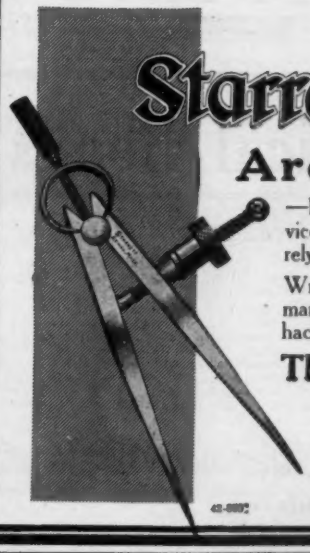

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applicable to cases where damages are based on reasonable royalty.—*B. F. Goodrich Co. v. Consolidated Rubber Tire Co. U. S. C. C. A. of Ill.*

Foreign Profits in Infringement.—Where defendant manufactured one of the infringing elements and shipped it abroad, and proof did not show that complainant had obtained the patent from the foreign country, complainant is not entitled to royalties upon defendant's foreign sales. *B. F. Goodrich Co. v. Consolidated Rubber Tire Co. U. S. C. C. A. of Ill.*

Combination without Invention not Patentable.—The Latham patent, No. 707,934, for a projecting kinetoscope, claim 7, employing a device taken from the prior art without developing any new functions, is invalid for want of patentable invention. If invention is wholly lacking, a patent cannot be sustained, even for the specific combination of contrived elements.—*Motion Picture Patent Co. v. Calehuff Supply Co. U. S. C. C. A. of Penna.*

New Law of Operation in Known Method.—Lewton patent for a reinforced concrete bridge having spandrel walls, in view of the prior art and anologous art, held, void for lack of invention—and Lewton patent for a reinforcing bar for concrete, having projection of such height and spacing that the space between adjacent projections is more than ten times the height of the projection, held, void for lack of invention. Discovery of a previously unknown law of operation, involved in a known method is not invention.—*Lewton v. Whittier. U. S. C. C. A. of Ohio*

The Benefit of Doubt.—Where extreme importance of raising sulfur from great depths to surface of ground was widely recognised prior to an invention, yet the inventor alone achieved the result, the law requires that, whatever question may exist as to the patentability of his improved apparatus and process, so far as consistent with reason, should be resolved in favor of patentability.—*Union Sulphur Co. v. Freeport Texas Co. U. S. D. C. of Del.*

Infringement of Basic Patent.—If defendant shows the deletion of one element, without substitution, it escapes infringement, notwithstanding plaintiff be something of a pioneer and as such entitled to a considerable range of equivalents. Boenning patent No. 709,864 for a machine for edge uniting veneers, is so far basic as to be entitled to lay claim to the essential so-called feeding parts of both the Black patent, No. 1,010,846, and defendant's machine manufactured substantially in accordance with its teaching, and to entitle plaintiff to a decree restraining refringement, and for an accounting.—*Ritter v. Veneer Machinery Co. U. S. C. C. A. of Ind.*

Suit against Aliens.—Aliens are not inhabitants of any district, and in patent cases the restrictions prescribed by section 48 of statutes do not apply, and aliens may be sued in any district within which process can be served on them. Where the bill alleged that defendants infringed within the district where suit was brought and elsewhere in the United States, and defendants by their answer to the merits waived any right to object that suit was brought in a district other than that in which they had a place of business, it is open to plaintiffs to show infringement in any place in the United States.—*Sandusky Fdy. & Mche. Co. v. De Lavaud. U. S. D. C. of Ohio.*

A Question of Novelty and Utility.—That elements entering into mechanical combination, considered apart from each other, are old and well known, does not negative patentability where, through inventive faculty, they are assembled so as to produce a new and useful result—the same being true of the various steps entering into a patented process. An invention may be patentable as possessing utility in the sense of the law, though an improvement may be necessary to its commercial success.—*Union Sulphur Co. v. Freeport Texas Co. U. S. D. C. of Del.*

Application not Publication.—Though patent application suggested a device later invented and patented by another, yet where no patent therefor was granted, and no such device constructed or brought into use, the suggestion in the application does not show prior invention. Until a patent is issued the public have no right of access to the application, and so until issuance of the patent the application cannot be regarded as a prior foreclosure or publication of matters set forth therein.—*Camp Bros. Co. v. Portable Wagon Dump & Elevator Co. U. S. C. C. A. of Ill.*

PATENTS

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But Johns-Manville salesmen have never been of the kid-glove variety. They are first of all sales-engineers, and it is a source of just and lasting pride to us that the emergencies of war-time found them ready.

How to save heat and fuel, how to guard against fire—these are the lessons they have carried into countless plants the country over. It is not too much to say that by their man-to-man methods of preaching Asbestos and Conservation, our salesmen have rendered here at home a distinct service to the nation, have made a notable contribution to the efficiency of our war-machine, have helped the country in no small way to weather a national fuel crisis.

So we are proud that our men, appearing to advantage whether in business garb or overalls, have so completely justified the basic Johns-Manville policy. This policy is Service — the basis on which our goods are sold, the basis on which the properties of Asbestos are exploited, the very platform of our business. And as a personification of this policy, we can conceive of nothing more creditable to Johns-Manville than our salesmen in overalls, "helping out."

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories — Branches in 63 Large Cities

Asbestos and Magnesia Heat Insulations, Packings, Refractory Cements, Steam Traps, and other Power Plant Materials; Asbestos Roofings and Shingles; Electrical Products; Asbestos Brake Lining, Fire Extinguishers, Speedometers.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

Through—

Asbestos
and its allied products

INSULATION
that keeps the heat where it belongs
CEMENTS
that make boiler walls leak-proof
ROOFINGS
that cut down fire risks
PACKINGS
that save power waste
LININGS
that make brakes safe
FIRE PREVENTION PRODUCTS

-and so:

JOHNS-MANVILLE
Serves in Conservation

MARMON
34

Advanced Engineering

Performing a necessary service in the most efficient and most economical manner known to engineering genius, and having, in addition, the virtue of beauty that endures. Than this there is nothing more to be had in the automotive industry.

136-Inch Wheelbase
1100 Pounds Lighter

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Established 1851
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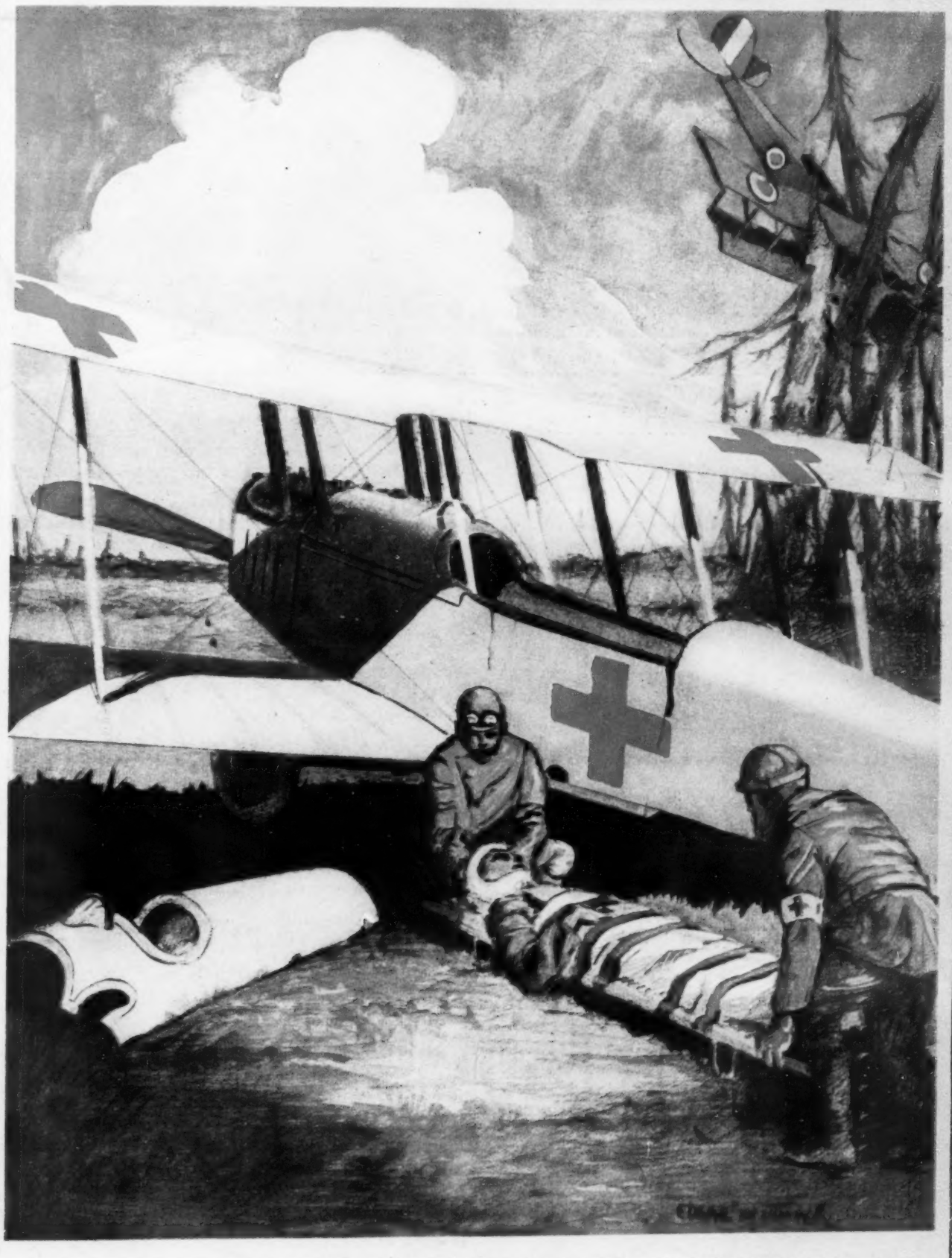
Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

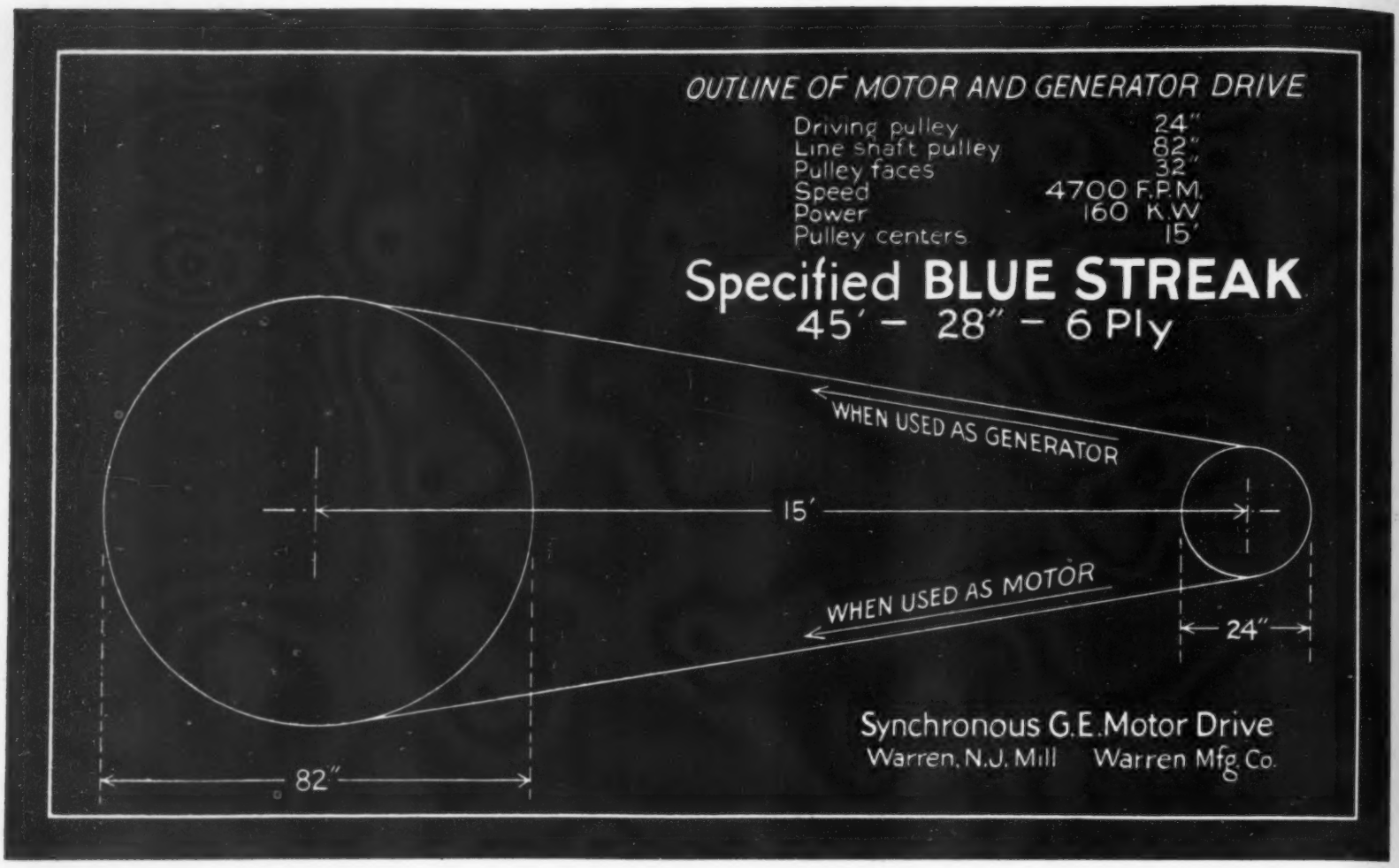


A HUMANITARIAN USE FOR THE AIRPLANE: COLLECTING THE WOUNDED WITH THE FLYING AMBULANCE [See page 461]

Vol. CXIX. No. 23
December 7, 1918

Published Weekly by
Munn & Co., Inc., New York, N. Y.

Price 10 Cents
$5.00 a Year



Making One Belt—and the G.T.M.—Do the Work of Three

Three belts had been devoured in twelve months by a certain motor drive in the Warren Manufacturing Company's Warren, N. J., plant. All were large belts. Some were expensive belts. Together the three loaded that drive with a pretty figure of operating costs. While the third belt was petering out, a G.T.M.—Goodyear Technical Man—called. It was our Mr. Ford.

They looked at his card, asked him in, listened a while, and asked the price of a belt for that motor drive. The G. T. M. didn't even take time to ask the width of the belt—he just said that he didn't know the price. Before they could ask him what kind of salesman he was, he told them about the Goodyear plan of selling belts—of thoroughly studying conditions and then prescribing the belt that would meet those conditions most efficiently and economically. They thought of three belts of the past twelve months and reasoned that they had nothing to lose by trying the plan.

He studied that drive. It was a hard one. The speed was close to a mile a minute—and when the motor was not used as an auxiliary for driving seven beaters, it was reversed and used as a generator. The centers were short. There were a number of other peculiar conditions—but after the G. T. M. got through studying them he knew just what to do—he had seen some drives very like it and had tried out his prescription.

After allowing for special circumstances he prescribed a belt of only six plies—although many a power engineer would have said that more were necessary. But he knew the proved strength of every Blue Streak ply—a brute strength as remarkable as its pulley hugging grip. So he prescribed a twenty-eight inch six-ply Blue Streak—made endless. Although he had had great success with special fasteners of various types to fit certain conditions, he knew that the best of fasteners were hopeless here—so it was a Blue Streak made endless.

That belt was applied in November, 1916. Its cost was less than one of the three belts that had been so disappointing, and yet that Blue Streak lasted longer than the three together. That synchronous drive doesn't pile up any more undue costs for the seven beaters it serves, doesn't cause interruptions nor lowered efficiency any more.

If you have a belt-devouring drive that is eating too many dollars, ask a G.T.M. to call. He'll do it without charge when he is in your vicinity. There are many of them—all trained in the Goodyear Technical School—all with experience in plants similar to yours—all selling belts to meet conditions and not as a hardware store sells nails. The G. T. M.'s services are free simply because the savings they effect for purchasers are so considerable that a gratifying volume of business from the plants served is certain to come to us within a few years.

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Five cents is now the prevailing tax for a clean collar levied by many laundries in Philadelphia and the suburbs.

A year ago collars were laundered for two and a half cents. Then the price jumped to three and four cents. It now costs nearly half as much to clean a collar as it did formerly to buy a new one.

"It cannot be

Why Pay 5c Daily For Laundering Collars?

Wear a collar that requires no upkeep! Save laundry bills, constant collar expense, fuel, labor and money. Six Challenge Cleanable Collars, at a total cost of $2, will cut $22 from your year's expenses.

CHALLENGE *CLEANABLE* COLLARS

(A Du Pont Product)

are non-wilting, can be cleaned in a minute and worn immediately. Neat, stylish and dressy. For business or pleasure. Dull linen finish. Made in all popular styles and half sizes. 35c each or $1.00 for three. At most dealers or check Challenge Collars in the coupon, give style and size desired and send 35c for sample.

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	Sanitary Wall Finish		Leather Solutions
	Town & Country Paint		Soluble Cotton
	Vitrolac Varnish		Metal Lacquers
	Flowkote Enamel		Wood Lacquers
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